

Mike Frazin

Tom Pickens



1
00:00:04,230 --> 00:00:02,310
all right let's begin with uh with that

2
00:00:05,749 --> 00:00:04,240
let's go from uh that to mike foale

3
00:00:07,510 --> 00:00:05,759
who's looking longingly kind of wishing

4
00:00:08,629 --> 00:00:07,520
he was up there i think uh mike why

5
00:00:10,230 --> 00:00:08,639
don't you why don't you talk a little

6
00:00:11,990 --> 00:00:10,240
bit about um

7
00:00:14,310 --> 00:00:12,000
some of the specifics of how you could

8
00:00:17,189 --> 00:00:14,320
envision uh the space station being

9
00:00:18,870 --> 00:00:17,199
utilized in the future well uh miles i'm

10
00:00:20,950 --> 00:00:18,880
gonna you gave me 10 minutes and i i

11
00:00:22,230 --> 00:00:20,960
just want to make sure that people

12
00:00:24,470 --> 00:00:22,240
know a little bit

13
00:00:28,870 --> 00:00:24,480

of the context i'm an active astronaut

14

00:00:33,270 --> 00:00:30,630

and have to be careful what i commit my

15

00:00:35,910 --> 00:00:33,280

colleagues to or not doing and when i i

16

00:00:38,229 --> 00:00:35,920

talk here behind this panel

17

00:00:39,910 --> 00:00:38,239

i uh my mother's just for those of you

18

00:00:41,590 --> 00:00:39,920

who don't know me my british accents uh

19

00:00:54,150 --> 00:00:41,600

it's all right i'm an authenticated

20

00:00:57,750 --> 00:00:56,470

my first flight uh actually

21

00:00:58,389 --> 00:00:57,760

i've flown five times on the space

22

00:01:00,549 --> 00:00:58,399

shuttle

23

00:01:01,830 --> 00:01:00,559

one time on a sawyer's rocket

24

00:01:03,510 --> 00:01:01,840

on the times i flew in the shuttle the

25

00:01:05,429 --> 00:01:03,520

first two flights were scientific

26
00:01:08,149 --> 00:01:05,439
missions uh independent of a space

27
00:01:09,510 --> 00:01:08,159
station observing the earth from space

28
00:01:11,910 --> 00:01:09,520
it was the atlas one and that was two

29
00:01:13,830 --> 00:01:11,920
series of missions on sts 45 and 56

30
00:01:15,670 --> 00:01:13,840
happened to be with charlie bolden

31
00:01:18,550 --> 00:01:15,680
my commander my first commander he was a

32
00:01:22,789 --> 00:01:18,560
wonderful commander

33
00:01:26,230 --> 00:01:24,149
now

34
00:01:28,390 --> 00:01:26,240
i want to make that point seriously he

35
00:01:29,350 --> 00:01:28,400
told me to get a will and none of us had

36
00:01:31,350 --> 00:01:29,360
wills

37
00:01:33,670 --> 00:01:31,360
of the new guys

38
00:01:36,630 --> 00:01:33,680

we are dealing with a risky business and

39

00:01:38,550 --> 00:01:36,640

i thank him for the advice

40

00:01:40,390 --> 00:01:38,560

that said i flew five times on the space

41

00:01:41,910 --> 00:01:40,400

shuttle and then one more time on a

42

00:01:43,910 --> 00:01:41,920

soyuz rocket

43

00:01:46,149 --> 00:01:43,920

those science missions were important

44

00:01:51,030 --> 00:01:46,159

but of course we were even then looking

45

00:01:56,149 --> 00:01:53,749

in 1997 i had a great adventure which

46

00:01:57,990 --> 00:01:56,159

was to be launched to the mir space

47

00:02:00,870 --> 00:01:58,000

station and i was launched on a space

48

00:02:02,069 --> 00:02:00,880

shuttle that took me in a model which we

49

00:02:05,030 --> 00:02:02,079

were going to use i think a lot today

50

00:02:06,870 --> 00:02:05,040

which was the taxi model

51
00:02:08,790 --> 00:02:06,880
that is there were seven crew members

52
00:02:11,430 --> 00:02:08,800
and i was the seventh and i was

53
00:02:14,070 --> 00:02:11,440
delivered to a space station and then

54
00:02:15,830 --> 00:02:14,080
the space shuttle left sts-84 left and

55
00:02:17,510 --> 00:02:15,840
left me on

56
00:02:19,270 --> 00:02:17,520
the space station mir

57
00:02:20,949 --> 00:02:19,280
not without a ride home i should add but

58
00:02:21,750 --> 00:02:20,959
at least

59
00:02:23,510 --> 00:02:21,760
my

60
00:02:26,470 --> 00:02:23,520
planned time home was dependent on the

61
00:02:28,710 --> 00:02:26,480
next ride coming up

62
00:02:31,270 --> 00:02:28,720
on the mirror uh i did some science but

63
00:02:33,990 --> 00:02:31,280

it was interrupted by a series of um

64

00:02:37,030 --> 00:02:34,000

unfortunate events on the uh mere

65

00:02:39,030 --> 00:02:37,040

stations and it was probably the lowest

66

00:02:41,509 --> 00:02:39,040

point in the russian space program that

67

00:02:43,430 --> 00:02:41,519

i've had any experience with since then

68

00:02:45,110 --> 00:02:43,440

when it when a cargo ship collided with

69

00:02:46,390 --> 00:02:45,120

the mirror station since then the

70

00:02:48,710 --> 00:02:46,400

russians have been extraordinarily

71

00:02:50,229 --> 00:02:48,720

reliable partners and we as a result of

72

00:02:51,750 --> 00:02:50,239

that collision i think paid a lot more

73

00:02:52,949 --> 00:02:51,760

attention to what russia was doing in

74

00:02:54,470 --> 00:02:52,959

its program

75

00:02:56,470 --> 00:02:54,480

and so today

76

00:02:58,710 --> 00:02:56,480

they do represent

77

00:03:00,550 --> 00:02:58,720

the united states method for getting

78

00:03:02,710 --> 00:03:00,560

astronauts to the international space

79

00:03:05,430 --> 00:03:02,720

station in a model which i would call

80

00:03:07,589 --> 00:03:05,440

the rental car model whereby the

81

00:03:09,589 --> 00:03:07,599

astronauts that are going astronauts and

82

00:03:10,949 --> 00:03:09,599

cosmos that are going to the space

83

00:03:12,630 --> 00:03:10,959

station are on the vehicle that they

84

00:03:16,550 --> 00:03:12,640

would come home in

85

00:03:20,910 --> 00:03:18,390

when i went to the international space

86

00:03:24,470 --> 00:03:20,920

station as the commander in uh

87

00:03:26,229 --> 00:03:24,480

2003 2004 i went

88

00:03:28,710 --> 00:03:26,239

uh

89

00:03:30,949 --> 00:03:28,720

with only six months of training on that

90

00:03:32,630 --> 00:03:30,959

soyuz vehicle

91

00:03:33,670 --> 00:03:32,640

because up to that point i had intended

92

00:03:35,990 --> 00:03:33,680

to go

93

00:03:38,630 --> 00:03:36,000

on the space shuttle and we had colombia

94

00:03:41,110 --> 00:03:38,640

columbia occurred and we were rapidly re

95

00:03:43,430 --> 00:03:41,120

directed um all of us

96

00:03:45,190 --> 00:03:43,440

to recover from that accident and my

97

00:03:47,670 --> 00:03:45,200

part in it was to

98

00:03:49,750 --> 00:03:47,680

sustain space station operations

99

00:03:51,589 --> 00:03:49,760

post columbia on the international space

100

00:03:52,710 --> 00:03:51,599

station with one other crew member one

101
00:03:54,550 --> 00:03:52,720
other person

102
00:03:56,070 --> 00:03:54,560
um alexander cleary i have a general

103
00:03:58,630 --> 00:03:56,080
theme here which is the more people on

104
00:04:00,309 --> 00:03:58,640
the space station the more i think we

105
00:04:02,550 --> 00:04:00,319
will get out of it i think interaction

106
00:04:04,229 --> 00:04:02,560
in general with a fairly large number of

107
00:04:05,589 --> 00:04:04,239
people on the station is quite realistic

108
00:04:06,869 --> 00:04:05,599
if there are psychologists here saying

109
00:04:08,949 --> 00:04:06,879
there's a problem

110
00:04:11,030 --> 00:04:08,959
um in general i i've always had the most

111
00:04:12,789 --> 00:04:11,040
positive experiences of the larger crews

112
00:04:16,229 --> 00:04:12,799
and with two people it was rather hard

113
00:04:20,270 --> 00:04:18,710

on the space station

114

00:04:23,990 --> 00:04:20,280

at that time in

115

00:04:25,590 --> 00:04:24,000

2004 we had one visiting vehicle

116

00:04:27,430 --> 00:04:25,600

that was a progress that came it came

117

00:04:28,469 --> 00:04:27,440

around about christmas

118

00:04:30,950 --> 00:04:28,479

this year

119

00:04:32,790 --> 00:04:30,960

about 20 vehicles are going to visit the

120

00:04:36,469 --> 00:04:32,800

international space station

121

00:04:39,909 --> 00:04:36,479

so when he says 500 people in a week we

122

00:04:41,909 --> 00:04:39,919

have a serious parking problem i mean

123

00:04:45,110 --> 00:04:41,919

their traffic model does need to

124

00:04:47,749 --> 00:04:45,120

increase and it's critical

125

00:04:50,070 --> 00:04:47,759

that that traffic module of once every

126
00:04:53,270 --> 00:04:50,080
six months that the astronaut office

127
00:04:54,710 --> 00:04:53,280
thinks of is thrown away

128
00:04:57,110 --> 00:04:54,720
we need to have

129
00:04:58,790 --> 00:04:57,120
a much more frequent traffic model going

130
00:05:00,390 --> 00:04:58,800
to the international space station i

131
00:05:02,390 --> 00:05:00,400
think there are lots of ways

132
00:05:06,070 --> 00:05:02,400
there's lots of reasons why that could

133
00:05:09,590 --> 00:05:07,590
the other thing about

134
00:05:10,629 --> 00:05:09,600
my most recent experience

135
00:05:13,110 --> 00:05:10,639
was that

136
00:05:15,350 --> 00:05:13,120
with the columbia down

137
00:05:17,749 --> 00:05:15,360
with the shuttle system down

138
00:05:20,070 --> 00:05:17,759

the united states had this incredible

139

00:05:21,189 --> 00:05:20,080

investment in space extraordinary amount

140

00:05:23,110 --> 00:05:21,199

of money

141

00:05:26,070 --> 00:05:23,120

and yet we didn't have access to it

142

00:05:28,230 --> 00:05:26,080

without reverting to or resorting to a

143

00:05:29,590 --> 00:05:28,240

parallel path to low earth orbit which

144

00:05:31,510 --> 00:05:29,600

was

145

00:05:34,070 --> 00:05:31,520

the russians

146

00:05:36,230 --> 00:05:34,080

and that parallel path is key to i think

147

00:05:38,230 --> 00:05:36,240

the direction that we're hearing today

148

00:05:40,870 --> 00:05:38,240

in the

149

00:05:43,189 --> 00:05:40,880

president's proposal to enable

150

00:05:45,189 --> 00:05:43,199

commercial space flight to low earth

151
00:05:47,909 --> 00:05:45,199
orbit

152
00:05:49,830 --> 00:05:47,919
we need a redundant and parallel path as

153
00:05:51,430 --> 00:05:49,840
a nation to get to our investment in

154
00:05:53,270 --> 00:05:51,440
space that would be true even if we were

155
00:05:54,469 --> 00:05:53,280
trying to go to the moon and even if we

156
00:05:56,710 --> 00:05:54,479
were trying to go beyond the moon to

157
00:05:58,710 --> 00:05:56,720
mars or to for example an I1 propellant

158
00:06:00,309 --> 00:05:58,720
depot either way you need if you're

159
00:06:02,550 --> 00:06:00,319
going to put a lot of money into an

160
00:06:04,469 --> 00:06:02,560
object in space that you need to get to

161
00:06:06,230 --> 00:06:04,479
you need to have two ways to get there

162
00:06:09,430 --> 00:06:06,240
at least

163
00:06:11,909 --> 00:06:09,440

that said with a strong russian partner

164

00:06:14,230 --> 00:06:11,919

and a u.s national launch system

165

00:06:16,070 --> 00:06:14,240

we meet the requirements i believe of

166

00:06:18,070 --> 00:06:16,080

parallel path to get to our investment

167

00:06:20,469 --> 00:06:18,080

but when the space shuttle goes is

168

00:06:22,390 --> 00:06:20,479

retired we are now ex

169

00:06:23,909 --> 00:06:22,400

we're in a difficult position and the

170

00:06:25,430 --> 00:06:23,919

russians are in a difficult position

171

00:06:27,189 --> 00:06:25,440

they are the only path to the

172

00:06:29,110 --> 00:06:27,199

international space station and they

173

00:06:30,870 --> 00:06:29,120

won't be as happy with that situation

174

00:06:32,710 --> 00:06:30,880

really as we are

175

00:06:34,870 --> 00:06:32,720

any happier i mean

176

00:06:37,670 --> 00:06:34,880

so the the point i'm making here is it's

177

00:06:39,270 --> 00:06:37,680

very important that the commercial crew

178

00:06:42,870 --> 00:06:39,280

efforts to get

179

00:06:44,710 --> 00:06:42,880

astronauts to space station happen soon

180

00:06:46,390 --> 00:06:44,720

and i i have had the privilege to take

181

00:06:48,390 --> 00:06:46,400

part in assessing

182

00:06:49,510 --> 00:06:48,400

the nasa commercial needs for getting

183

00:06:52,070 --> 00:06:49,520

crew to

184

00:06:53,749 --> 00:06:52,080

to space station and to low earth orbit

185

00:06:56,629 --> 00:06:53,759

and my mantra in all of those

186

00:06:59,350 --> 00:06:56,639

assessments was soon the sooner you can

187

00:07:02,950 --> 00:06:59,360

achieve this the better

188

00:07:05,670 --> 00:07:02,960

this commercial effort also will fail

189

00:07:08,469 --> 00:07:05,680

in my mind if it only produces one

190

00:07:12,790 --> 00:07:10,629

provider of launch services there needs

191

00:07:15,270 --> 00:07:12,800

to be more than one provider of launch

192

00:07:17,830 --> 00:07:15,280

services for the united states to low

193

00:07:19,189 --> 00:07:17,840

earth orbit if it's really a success

194

00:07:21,430 --> 00:07:19,199

because then it does make the united

195

00:07:23,589 --> 00:07:21,440

states independent of

196

00:07:25,589 --> 00:07:23,599

another nation's capability

197

00:07:26,870 --> 00:07:25,599

or you invite more nations into the

198

00:07:29,110 --> 00:07:26,880

international space station and your

199

00:07:30,469 --> 00:07:29,120

projects to make those parallel paths so

200

00:07:32,309 --> 00:07:30,479

there's two ways to do it for the united

201
00:07:34,469 --> 00:07:32,319
states one is to create more than one

202
00:07:37,749 --> 00:07:34,479
provider in the u.s or have more

203
00:07:39,029 --> 00:07:37,759
partners international partners

204
00:07:40,870 --> 00:07:39,039
uh

205
00:07:42,309 --> 00:07:40,880
science on the station i have had i

206
00:07:43,990 --> 00:07:42,319
really enjoy science i'm a physicist

207
00:07:45,990 --> 00:07:44,000
astrophysicist

208
00:07:49,189 --> 00:07:46,000
i did a set of experiments on the space

209
00:07:51,029 --> 00:07:49,199
station that i found very interesting

210
00:07:52,710 --> 00:07:51,039
about 72 experiments were taking place

211
00:07:54,070 --> 00:07:52,720
while i was there

212
00:07:56,309 --> 00:07:54,080
only about three or four of them really

213
00:07:58,469 --> 00:07:56,319

involved me directly

214

00:08:00,869 --> 00:07:58,479

two of us were on the station and i was

215

00:08:02,629 --> 00:08:00,879

spending about a quarter of my time at

216

00:08:04,790 --> 00:08:02,639

the most doing science on the space

217

00:08:07,270 --> 00:08:04,800

station today with a six-person crew a

218

00:08:09,110 --> 00:08:07,280

much larger fraction i think is spent of

219

00:08:12,309 --> 00:08:09,120

the total crew time on science and

220

00:08:14,070 --> 00:08:12,319

should be spent on science but then

221

00:08:15,830 --> 00:08:14,080

we were sustaining station operations

222

00:08:17,430 --> 00:08:15,840

and we need

223

00:08:19,510 --> 00:08:17,440

we needed uh

224

00:08:21,670 --> 00:08:19,520

we needed experiments but we didn't have

225

00:08:23,990 --> 00:08:21,680

any way to launch them

226
00:08:25,670 --> 00:08:24,000
and i think in the end

227
00:08:28,150 --> 00:08:25,680
the eight kilometers a second that you

228
00:08:29,350 --> 00:08:28,160
need to get into low earth orbit

229
00:08:31,830 --> 00:08:29,360
is the key

230
00:08:33,269 --> 00:08:31,840
and is the barrier and is the problem to

231
00:08:35,509 --> 00:08:33,279
all of the things that we're addressing

232
00:08:36,709 --> 00:08:35,519
today and this shift to commercial crew

233
00:08:38,389 --> 00:08:36,719
is all about getting that eight

234
00:08:40,230 --> 00:08:38,399
kilometers a second for your payloads

235
00:08:42,310 --> 00:08:40,240
for your experiments for all the for the

236
00:08:44,149 --> 00:08:42,320
ticket buyers

237
00:08:45,350 --> 00:08:44,159
for the propellant depot in I1 it's all

238
00:08:46,790 --> 00:08:45,360

about

239

00:08:47,829 --> 00:08:46,800

overcoming that eight kilometer per

240

00:08:50,710 --> 00:08:47,839

second

241

00:08:53,190 --> 00:08:50,720

energy problem which is how much energy

242

00:08:56,310 --> 00:08:53,200

you need to get a person into space

243

00:08:58,150 --> 00:08:56,320

or a kilogram into space

244

00:09:01,030 --> 00:08:58,160

um i think it's fantastic that the iss

245

00:09:02,949 --> 00:09:01,040

is going to go to 2020. uh

246

00:09:04,949 --> 00:09:02,959

the iss is going to be used for i'm

247

00:09:07,030 --> 00:09:04,959

going to just roll them off robotics is

248

00:09:09,269 --> 00:09:07,040

one thing which the iss is developing

249

00:09:10,470 --> 00:09:09,279

but it's often missed out when we line

250

00:09:12,389 --> 00:09:10,480

up the technologies that are being

251
00:09:14,550 --> 00:09:12,399
discussed and the experiments being done

252
00:09:16,310 --> 00:09:14,560
robotics actually the assembly of the

253
00:09:17,509 --> 00:09:16,320
united of the us segment of the

254
00:09:19,030 --> 00:09:17,519
international

255
00:09:20,550 --> 00:09:19,040
space station is extraordinary when you

256
00:09:23,190 --> 00:09:20,560
think about it using the canadian

257
00:09:25,030 --> 00:09:23,200
robotic arm there's also the canadian

258
00:09:27,350 --> 00:09:25,040
dexter the flying manipulate and there's

259
00:09:29,110 --> 00:09:27,360
also a japanese arm but robotics in

260
00:09:30,949 --> 00:09:29,120
general is a

261
00:09:32,470 --> 00:09:30,959
turns out to be a really enabling thing

262
00:09:34,389 --> 00:09:32,480
on the international space station in

263
00:09:37,350 --> 00:09:34,399

its construction but i think if it goes

264

00:09:39,910 --> 00:09:37,360

further towards propellant transfer into

265

00:09:41,269 --> 00:09:39,920

the enabling of propellant depots beyond

266

00:09:43,350 --> 00:09:41,279

low earth orbit

267

00:09:45,110 --> 00:09:43,360

if that's if that turns out to be a good

268

00:09:46,949 --> 00:09:45,120

way to go beyond the earth orbit there

269

00:09:48,630 --> 00:09:46,959

may be some cool propellant solutions

270

00:09:50,389 --> 00:09:48,640

out there that don't need that but the

271

00:09:52,230 --> 00:09:50,399

way i see it is we will need propellant

272

00:09:54,790 --> 00:09:52,240

depot

273

00:09:57,430 --> 00:09:56,389

i want to

274

00:10:00,389 --> 00:09:57,440

i'm going to talk about what i'd like to

275

00:10:01,430 --> 00:10:00,399

see in space now

276

00:10:02,790 --> 00:10:01,440

i think the greatest thing that's been

277

00:10:04,150 --> 00:10:02,800

done by the international space station

278

00:10:05,590 --> 00:10:04,160

is the partnership with the with

279

00:10:06,630 --> 00:10:05,600

internationals

280

00:10:08,470 --> 00:10:06,640

uh

281

00:10:10,069 --> 00:10:08,480

and i think

282

00:10:12,310 --> 00:10:10,079

all kinds of they're all yes there's

283

00:10:14,949 --> 00:10:12,320

bureaucracy yes there's uh difficulty in

284

00:10:17,110 --> 00:10:14,959

language and interaction but it's an

285

00:10:19,350 --> 00:10:17,120

international partnership ends up being

286

00:10:20,870 --> 00:10:19,360

the most sustainable program for a

287

00:10:22,949 --> 00:10:20,880

nation

288

00:10:24,550 --> 00:10:22,959

would it be easy to cancel constellation

289

00:10:26,470 --> 00:10:24,560

if it was international

290

00:10:28,150 --> 00:10:26,480

i don't believe so

291

00:10:30,230 --> 00:10:28,160

the space station has been right on one

292

00:10:32,790 --> 00:10:30,240

vote for cancellation but international

293

00:10:34,630 --> 00:10:32,800

helped sustain it and in the end

294

00:10:36,230 --> 00:10:34,640

international helped us get over the

295

00:10:37,990 --> 00:10:36,240

period when we lost our national launch

296

00:10:39,750 --> 00:10:38,000

capability

297

00:10:41,590 --> 00:10:39,760

so i think international partnerships

298

00:10:43,350 --> 00:10:41,600

should be continued and developed for

299

00:10:46,949 --> 00:10:43,360

the international space station in its

300

00:10:48,710 --> 00:10:46,959

development in in increasing access

301
00:10:50,310 --> 00:10:48,720
um parallel redundant access i've

302
00:10:52,069 --> 00:10:50,320
mentioned

303
00:10:53,670 --> 00:10:52,079
i think more people

304
00:10:54,870 --> 00:10:53,680
um should be sent to the station let me

305
00:10:56,389 --> 00:10:54,880
give you an idea from an astronaut's

306
00:10:57,829 --> 00:10:56,399
point of view

307
00:10:59,269 --> 00:10:57,839
my astronaut colleagues say well how

308
00:11:00,630 --> 00:10:59,279
will i fly to the station if you know

309
00:11:02,310 --> 00:11:00,640
we're going once every six months

310
00:11:03,829 --> 00:11:02,320
there's only three persons

311
00:11:05,750 --> 00:11:03,839
uh possibly you know four to four

312
00:11:07,750 --> 00:11:05,760
persons per year out of the action

313
00:11:10,310 --> 00:11:07,760

office there's no career

314

00:11:11,509 --> 00:11:10,320

not true if you go right back to what we

315

00:11:13,990 --> 00:11:11,519

thought we should do the station which

316

00:11:16,790 --> 00:11:14,000

is launch every three months or indeed

317

00:11:18,630 --> 00:11:16,800

we launched a taxi model which could be

318

00:11:20,310 --> 00:11:18,640

carrying not just three people or four

319

00:11:21,590 --> 00:11:20,320

people to the station but seven people

320

00:11:23,269 --> 00:11:21,600

to the station

321

00:11:24,790 --> 00:11:23,279

and the other three or four seats are

322

00:11:27,430 --> 00:11:24,800

occupied by people who are coming to set

323

00:11:28,870 --> 00:11:27,440

up their experiments tear them down they

324

00:11:31,590 --> 00:11:28,880

come to visit for as long as that

325

00:11:33,350 --> 00:11:31,600

vehicle wants to stay at the station

326

00:11:35,910 --> 00:11:33,360

if it happens to be the lifeboat it will

327

00:11:37,829 --> 00:11:35,920

stay if it if there's a lifeboat already

328

00:11:39,910 --> 00:11:37,839

at the station for assured return then

329

00:11:42,949 --> 00:11:39,920

the taxi can return

330

00:11:44,949 --> 00:11:42,959

and be used again for another flight

331

00:11:46,630 --> 00:11:44,959

and increase the traffic model of the

332

00:11:48,150 --> 00:11:46,640

provider so that their business case is

333

00:11:49,829 --> 00:11:48,160

better

334

00:11:50,870 --> 00:11:49,839

so i think the key to the station is

335

00:11:53,269 --> 00:11:50,880

getting more

336

00:11:55,030 --> 00:11:53,279

and and the type it could be and i'll

337

00:11:56,790 --> 00:11:55,040

talk about national lab i think national

338

00:11:58,710 --> 00:11:56,800

institutes of health i think darpa could

339

00:12:00,230 --> 00:11:58,720

have its own section

340

00:12:01,829 --> 00:12:00,240

there are reasons why you can't do

341

00:12:03,910 --> 00:12:01,839

military

342

00:12:05,030 --> 00:12:03,920

and defense oriented

343

00:12:06,310 --> 00:12:05,040

projects on the international space

344

00:12:08,150 --> 00:12:06,320

station because it's an international

345

00:12:09,750 --> 00:12:08,160

space station but there's no reason why

346

00:12:11,350 --> 00:12:09,760

and we do do

347

00:12:12,790 --> 00:12:11,360

commercial

348

00:12:14,470 --> 00:12:12,800

proprietary

349

00:12:16,069 --> 00:12:14,480

experiments and activities on the space

350

00:12:17,590 --> 00:12:16,079

station and we've already taken part of

351

00:12:19,269 --> 00:12:17,600

that and some of those products are

352

00:12:22,069 --> 00:12:19,279

already in the market in terms of

353

00:12:25,509 --> 00:12:22,079

protein crystal growth and other samples

354

00:12:27,190 --> 00:12:25,519

so i think uh data protection i think

355

00:12:28,949 --> 00:12:27,200

commercial and proprietary operations on

356

00:12:31,269 --> 00:12:28,959

the station are all things that that in

357

00:12:33,509 --> 00:12:31,279

the future and could be done with a

358

00:12:34,870 --> 00:12:33,519

larger seat seat and load factor to the

359

00:12:36,550 --> 00:12:34,880

station than we have currently on the

360

00:12:39,590 --> 00:12:36,560

soyuz

361

00:12:41,829 --> 00:12:39,600

is the only vehicle that carries people

362

00:12:43,350 --> 00:12:41,839

to the station to live there the shuttle

363

00:12:44,470 --> 00:12:43,360

visits but it doesn't leave anybody

364

00:12:45,509 --> 00:12:44,480

there anymore

365

00:12:47,990 --> 00:12:45,519

uh we had

366

00:12:50,629 --> 00:12:48,000

the last one was i think uh nicole start

367

00:12:54,790 --> 00:12:52,710

and finally i'd like to say uh

368

00:12:56,389 --> 00:12:54,800

i don't think space station should ever

369

00:13:00,710 --> 00:12:56,399

be deorbited

370

00:13:01,829 --> 00:13:00,720

um and and that's not just a whim

371

00:13:03,750 --> 00:13:01,839

if

372

00:13:06,790 --> 00:13:03,760

franklin shang diaz is an astronaut who

373

00:13:09,910 --> 00:13:06,800

i know well um

374

00:13:12,150 --> 00:13:09,920

who is a visionary he he was a fusion

375

00:13:13,990 --> 00:13:12,160

physicist originally but has taken his

376

00:13:15,430 --> 00:13:14,000

skills he's from mit

377

00:13:17,910 --> 00:13:15,440

um

378

00:13:18,949 --> 00:13:17,920

to develop a plasma rocket and then and

379

00:13:21,670 --> 00:13:18,959

there are other ways to get what's

380

00:13:23,829 --> 00:13:21,680

called high isp thrust out of an engine

381

00:13:25,509 --> 00:13:23,839

but he has a system and it's a it's a

382

00:13:28,470 --> 00:13:25,519

fairly well developed

383

00:13:30,870 --> 00:13:28,480

engine that produces very low thrust but

384

00:13:32,949 --> 00:13:30,880

for a very very very long duration at a

385

00:13:35,350 --> 00:13:32,959

very very very high efficiency and it

386

00:13:37,590 --> 00:13:35,360

needs electrical power and i believe

387

00:13:39,030 --> 00:13:37,600

there's a technology program to put

388

00:13:40,150 --> 00:13:39,040

as one of the new technology programs to

389

00:13:41,990 --> 00:13:40,160

put that on the international space

390

00:13:44,150 --> 00:13:42,000

station that sort of system can get you

391

00:13:45,670 --> 00:13:44,160

to mars in about four to six weeks i did

392

00:13:49,110 --> 00:13:45,680

the original calculations for franklin

393

00:13:50,949 --> 00:13:49,120

back in the late 80s and 90s early 90s

394

00:13:52,310 --> 00:13:50,959

that system can get you to mars in four

395

00:13:54,389 --> 00:13:52,320

to six weeks

396

00:13:56,470 --> 00:13:54,399

spiraling out accelerating continuously

397

00:13:59,910 --> 00:13:56,480

and then halfway still spiraling

398

00:14:01,670 --> 00:13:59,920

decelerating it gets you into mars

399

00:14:03,509 --> 00:14:01,680

that's how you stop

400

00:14:05,350 --> 00:14:03,519

the damage of radiation for example in

401

00:14:06,949 --> 00:14:05,360

between and out of the earth's

402

00:14:09,030 --> 00:14:06,959

magnetosphere

403

00:14:10,870 --> 00:14:09,040

between earth and mars so if you get

404

00:14:12,550 --> 00:14:10,880

short travel times to mars short travel

405

00:14:14,550 --> 00:14:12,560

times to asteroids now you can hide

406

00:14:16,389 --> 00:14:14,560

behind your celestial body from the sun

407

00:14:17,910 --> 00:14:16,399

from a solar storm now you can hide from

408

00:14:19,590 --> 00:14:17,920

the galactic cosmic rays if you have

409

00:14:21,430 --> 00:14:19,600

materials at hand

410

00:14:23,030 --> 00:14:21,440

and so the key there is

411

00:14:24,710 --> 00:14:23,040

the space station needs to be used for

412

00:14:26,790 --> 00:14:24,720

propulsion and

413

00:14:29,750 --> 00:14:26,800

out of low earth orbit

414

00:14:33,110 --> 00:14:29,760

exploration development

415

00:14:35,189 --> 00:14:33,120

those uh uh so that same engine

416

00:14:36,550 --> 00:14:35,199

could be used to boost the station

417

00:14:38,550 --> 00:14:36,560

and it's part of the of the

418

00:14:41,670 --> 00:14:38,560

demonstration of showing

419

00:14:43,350 --> 00:14:41,680

that uh the vasometer as he calls it um

420

00:14:45,750 --> 00:14:43,360

works on the international space station

421

00:14:48,230 --> 00:14:45,760

in the next two or three years it should

422

00:14:50,629 --> 00:14:48,240

be and could be and be planned to lift

423

00:14:52,470 --> 00:14:50,639

the station eventually out of the low

424

00:14:54,230 --> 00:14:52,480

earth orbit that it's in now when we

425

00:14:55,910 --> 00:14:54,240

have decided that our vehicles no longer

426
00:14:57,269 --> 00:14:55,920
need to well for whatever reason we can

427
00:14:59,110 --> 00:14:57,279
get it higher so that it won't have to

428
00:15:01,110 --> 00:14:59,120
be disposed of

429
00:15:03,430 --> 00:15:01,120
it could one day be the the tourist side

430
00:15:05,509 --> 00:15:03,440
trip or the special government side trip

431
00:15:07,350 --> 00:15:05,519
on the way to an l1

432
00:15:10,470 --> 00:15:07,360
uh propellant tank farm

433
00:15:12,470 --> 00:15:10,480
between the earth and the moon

434
00:15:14,150 --> 00:15:12,480
i can obviously go on a long time but

435
00:15:15,670 --> 00:15:14,160
i've left the key

436
00:15:17,990 --> 00:15:15,680
we could talk about later on is how

437
00:15:20,230 --> 00:15:18,000
would be how would propellant depots

438
00:15:21,110 --> 00:15:20,240

meet the needs or so provide the market

439

00:15:22,550 --> 00:15:21,120

for

440

00:15:24,230 --> 00:15:22,560

uh commercial

441

00:15:26,230 --> 00:15:24,240

launch providers

442

00:15:27,910 --> 00:15:26,240

all right excellent mike there's lots of

443

00:15:29,590 --> 00:15:27,920

things to follow up on there including

444

00:15:31,829 --> 00:15:29,600

i'm curious about the power needs for

445

00:15:33,670 --> 00:15:31,839

something like uh about 1.5 megawatts

446

00:15:34,550 --> 00:15:33,680

was the for a vehicle about the size of

447

00:15:39,430 --> 00:15:34,560

the

448

00:15:41,110 --> 00:15:39,440

so probably something nuclear to make

449

00:15:42,870 --> 00:15:41,120

that doesn't have to be solar dynamic

450

00:15:45,829 --> 00:15:42,880

power was a solar collector that we were

451
00:15:46,790 --> 00:15:45,839
planning to launch on sts-86 to the mir

452
00:15:48,230 --> 00:15:46,800
station

453
00:15:49,590 --> 00:15:48,240
um i

454
00:15:52,389 --> 00:15:49,600
can't i think it was because of the

455
00:15:54,310 --> 00:15:52,399
space station freedom morphed into

456
00:15:56,790 --> 00:15:54,320
iss and about that time we changed the

457
00:15:58,069 --> 00:15:56,800
power plan from solar arrays to from

458
00:15:59,829 --> 00:15:58,079
from

459
00:16:01,590 --> 00:15:59,839
solar dynamic

460
00:16:03,110 --> 00:16:01,600
parabolic solar collectors which are

461
00:16:05,590 --> 00:16:03,120
much more efficient but the technology

462
00:16:07,670 --> 00:16:05,600
was still a lower readiness level and we

463
00:16:10,310 --> 00:16:07,680

shifted to a better known one which was

464

00:16:13,269 --> 00:16:10,320

the solar parade that was really why we

465

00:16:15,189 --> 00:16:13,279

dropped that mission to mir but

466

00:16:17,189 --> 00:16:15,199

that same sort of system could be

467

00:16:19,430 --> 00:16:17,199

renovated in fact it's highly topical

468

00:16:21,189 --> 00:16:19,440

and relevant today given the

469

00:16:22,949 --> 00:16:21,199

approach to solar energy

470

00:16:25,430 --> 00:16:22,959

all right let's move it to tom pickens

471

00:16:26,949 --> 00:16:25,440

there's an old expression in aviation i

472

00:16:28,790 --> 00:16:26,959

suppose it applies to space that if you

473

00:16:31,110 --> 00:16:28,800

want to make a small fortune start with

474

00:16:32,389 --> 00:16:31,120

a large one so uh he's proving that's

475

00:16:33,910 --> 00:16:32,399

wrong tomm why don't you tell us a

476

00:16:36,150 --> 00:16:33,920

little bit about what you're up to um

477

00:16:37,749 --> 00:16:36,160

let me go back to when i started to get

478

00:16:39,990 --> 00:16:37,759

involved in

479

00:16:42,870 --> 00:16:40,000

with space have which has now been

480

00:16:44,870 --> 00:16:42,880

renamed as to astrotech was i took over

481

00:16:48,870 --> 00:16:44,880

as ceo in

482

00:16:49,749 --> 00:16:48,880

in 2007 january of 2007

483

00:16:52,629 --> 00:16:49,759

and

484

00:16:55,189 --> 00:16:52,639

we knew that the space shuttle was going

485

00:16:57,350 --> 00:16:55,199

to retire they had made very definite

486

00:17:00,230 --> 00:16:57,360

plans to

487

00:17:02,470 --> 00:17:00,240

cease providing funding to the

488

00:17:04,789 --> 00:17:02,480

to the supply chain

489

00:17:06,870 --> 00:17:04,799

it was easy to see once you stopped

490

00:17:08,470 --> 00:17:06,880

putting a lot of those very integral

491

00:17:10,549 --> 00:17:08,480

pieces into the supply chain of the

492

00:17:12,549 --> 00:17:10,559

shuttle it wasn't long before you

493

00:17:14,069 --> 00:17:12,559

weren't going to be able to revive it

494

00:17:15,990 --> 00:17:14,079

and they had already told us that they

495

00:17:17,590 --> 00:17:16,000

weren't going to fly our space app

496

00:17:19,270 --> 00:17:17,600

modules any longer

497

00:17:21,429 --> 00:17:19,280

and they we knew that that was going to

498

00:17:22,949 --> 00:17:21,439

be over in august of 07.

499

00:17:24,630 --> 00:17:22,959

so we

500

00:17:26,949 --> 00:17:24,640

centralized our efforts over on our

501
00:17:30,070 --> 00:17:26,959
satellite processing business called

502
00:17:31,990 --> 00:17:30,080
astrotech space operations and then we

503
00:17:34,710 --> 00:17:32,000
made sure that that was in good in

504
00:17:36,710 --> 00:17:34,720
intact in in good order

505
00:17:39,270 --> 00:17:36,720
we had to do some refinancing of the

506
00:17:41,029 --> 00:17:39,280
company that was necessary and then once

507
00:17:42,950 --> 00:17:41,039
that was complete we then shifted over

508
00:17:44,310 --> 00:17:42,960
and said okay what are we going to do if

509
00:17:45,750 --> 00:17:44,320
anything at all

510
00:17:47,669 --> 00:17:45,760
and

511
00:17:50,230 --> 00:17:47,679
looking back at our heritage of sending

512
00:17:53,990 --> 00:17:50,240
science primarily for nasa in our space

513
00:17:55,430 --> 00:17:54,000

hub science modules and is there any uh

514

00:17:57,669 --> 00:17:55,440

opportunity that we may be able to

515

00:17:59,590 --> 00:17:57,679

identify while we

516

00:18:01,510 --> 00:17:59,600

if we want to stay in context with the

517

00:18:02,950 --> 00:18:01,520

company's history it wasn't a

518

00:18:05,190 --> 00:18:02,960

requirement it wasn't like we were

519

00:18:06,150 --> 00:18:05,200

looking to do that it wasn't like we

520

00:18:09,909 --> 00:18:06,160

were

521

00:18:12,150 --> 00:18:09,919

making a reason for continuing on in the

522

00:18:14,390 --> 00:18:12,160

space program but we did know that we

523

00:18:16,150 --> 00:18:14,400

had some special capabilities that we

524

00:18:18,230 --> 00:18:16,160

had learned a lot that we had been in

525

00:18:20,230 --> 00:18:18,240

the front of

526
00:18:22,230 --> 00:18:20,240
over a thousand experiments have flown

527
00:18:24,070 --> 00:18:22,240
in our spacehab modules and that we

528
00:18:25,830 --> 00:18:24,080
should have imminent knowledge on

529
00:18:26,789 --> 00:18:25,840
certain aspects of it that we would at

530
00:18:28,549 --> 00:18:26,799
least

531
00:18:29,909 --> 00:18:28,559
know where to point ourselves into the

532
00:18:31,990 --> 00:18:29,919
direction to

533
00:18:33,669 --> 00:18:32,000
or would it be easily

534
00:18:35,029 --> 00:18:33,679
available to us to go and get and

535
00:18:36,630 --> 00:18:35,039
garnish the information that was

536
00:18:38,789 --> 00:18:36,640
necessary in order to determine if there

537
00:18:41,029 --> 00:18:38,799
was a commercial application or not so

538
00:18:42,870 --> 00:18:41,039

we went to work and we spent a good and

539

00:18:44,470 --> 00:18:42,880

fair amount of time looking at uh most

540

00:18:46,630 --> 00:18:44,480

of the experiments i want to say all of

541

00:18:48,390 --> 00:18:46,640

them because there's been a whole lot

542

00:18:50,230 --> 00:18:48,400

done especially if you include the

543

00:18:52,230 --> 00:18:50,240

russians experiments as well over the

544

00:18:54,070 --> 00:18:52,240

many many years of you know starting off

545

00:18:56,950 --> 00:18:54,080

at apollo

546

00:18:58,230 --> 00:18:56,960

but we went and we looked at them and we

547

00:19:01,590 --> 00:18:58,240

quickly

548

00:19:03,750 --> 00:19:01,600

uh determined that the most valuable

549

00:19:06,150 --> 00:19:03,760

thing that you could send to space

550

00:19:08,630 --> 00:19:06,160

because of its lightweight nature and

551
00:19:10,470 --> 00:19:08,640
its high value would be into something

552
00:19:12,230 --> 00:19:10,480
that had to do with bio

553
00:19:14,470 --> 00:19:12,240
biotech

554
00:19:15,350 --> 00:19:14,480
and there were really two areas that

555
00:19:19,750 --> 00:19:15,360
were

556
00:19:22,470 --> 00:19:19,760
basic science and the work had

557
00:19:24,549 --> 00:19:22,480
come to some certain conclusions

558
00:19:28,070 --> 00:19:24,559
one of them was microbes when they sent

559
00:19:30,310 --> 00:19:28,080
the first uh microbes to space uh there

560
00:19:34,310 --> 00:19:30,320
was actually a conversation that was had

561
00:19:35,750 --> 00:19:34,320
between the astronauts and jsc that said

562
00:19:37,430 --> 00:19:35,760
uh wow

563
00:19:39,029 --> 00:19:37,440

is this dangerous

564

00:19:40,470 --> 00:19:39,039

because these things are growing way

565

00:19:43,029 --> 00:19:40,480

beyond what we were told they were

566

00:19:45,430 --> 00:19:43,039

supposed to be growing much faster much

567

00:19:48,390 --> 00:19:45,440

bigger and we're concerned

568

00:19:50,310 --> 00:19:48,400

and after some some give and take back

569

00:19:52,630 --> 00:19:50,320

with the scientists jsc reported back

570

00:19:55,270 --> 00:19:52,640

and said no the hardware is a good

571

00:19:56,950 --> 00:19:55,280

hardware and it will keep you safe but

572

00:19:58,390 --> 00:19:56,960

it was an indication that they had no

573

00:20:00,470 --> 00:19:58,400

idea what they were going to find and

574

00:20:02,390 --> 00:20:00,480

when they did it was

575

00:20:04,549 --> 00:20:02,400

it was surprising to them

576

00:20:07,110 --> 00:20:04,559

so what you can do with that is you can

577

00:20:10,070 --> 00:20:07,120

take microbes and you can send them up

578

00:20:12,549 --> 00:20:10,080

we have found now and in microgravity

579

00:20:14,549 --> 00:20:12,559

they do grow huge there are some

580

00:20:17,190 --> 00:20:14,559

theories as to why

581

00:20:20,149 --> 00:20:17,200

i think that i'm probably satisfied with

582

00:20:22,549 --> 00:20:20,159

the idea that they are it's a phenomena

583

00:20:25,270 --> 00:20:22,559

um i'm not sure i believe in any of the

584

00:20:27,190 --> 00:20:25,280

theories thus far but i do know that it

585

00:20:29,270 --> 00:20:27,200

is a physiological change with the

586

00:20:31,830 --> 00:20:29,280

growth of microbes and when you bring

587

00:20:33,350 --> 00:20:31,840

them back and you analyze them they show

588

00:20:35,990 --> 00:20:33,360

certain

589

00:20:38,470 --> 00:20:36,000

elevated levels of virulence or strength

590

00:20:40,390 --> 00:20:38,480

and that gives the scientists a very

591

00:20:42,630 --> 00:20:40,400

definite area to go look at when they

592

00:20:44,710 --> 00:20:42,640

start creating vaccines

593

00:20:46,950 --> 00:20:44,720

it's uh to kind of put into perspective

594

00:20:49,590 --> 00:20:46,960

of how valuable that might be

595

00:20:51,750 --> 00:20:49,600

a vaccine typically takes from 10 to 15

596

00:20:53,990 --> 00:20:51,760

years of using a process that's called

597

00:20:56,870 --> 00:20:54,000

microarray analysis which is a robotic

598

00:20:59,270 --> 00:20:56,880

arm that tries and tries and tries

599

00:21:01,270 --> 00:20:59,280

through a trial and error process in

600

00:21:02,870 --> 00:21:01,280

trying to figure out the one telephone

601
00:21:05,909 --> 00:21:02,880
number out of a hundred billion

602
00:21:07,830 --> 00:21:05,919
telephone potential numbers that are

603
00:21:09,830 --> 00:21:07,840
held with inside of a genome to try to

604
00:21:11,270 --> 00:21:09,840
figure out which one controls the

605
00:21:14,950 --> 00:21:11,280
strength of it

606
00:21:18,710 --> 00:21:14,960
and like cowpox was to smallpox cowpox

607
00:21:21,270 --> 00:21:18,720
was a lesser degree of smallpox but you

608
00:21:23,270 --> 00:21:21,280
have to control that virulent factor in

609
00:21:24,630 --> 00:21:23,280
order to be able to develop the vaccine

610
00:21:27,029 --> 00:21:24,640
synthetically

611
00:21:29,110 --> 00:21:27,039
so the problem is is that they start off

612
00:21:31,830 --> 00:21:29,120
with 100 billion telephone numbers

613
00:21:33,909 --> 00:21:31,840

and they really don't have much of a of

614

00:21:35,350 --> 00:21:33,919

an idea of really where to go and you

615

00:21:37,590 --> 00:21:35,360

you know try to figure out how to call

616

00:21:38,549 --> 00:21:37,600

me when the phone book's 100 billion

617

00:21:40,310 --> 00:21:38,559

tall

618

00:21:42,149 --> 00:21:40,320

and it'd take you a long time and that's

619

00:21:44,870 --> 00:21:42,159

why it takes them 10 to 15 years to

620

00:21:46,789 --> 00:21:44,880

develop a vaccine so when you send them

621

00:21:47,830 --> 00:21:46,799

to space and they come back they have a

622

00:21:49,590 --> 00:21:47,840

control

623

00:21:51,830 --> 00:21:49,600

sample that they do right here at the

624

00:21:53,909 --> 00:21:51,840

sisl on uh

625

00:21:56,149 --> 00:21:53,919

here at the cape and we have

626
00:21:57,909 --> 00:21:56,159
communications with the shuttle and we

627
00:21:59,669 --> 00:21:57,919
are transferring back and forth the

628
00:22:01,830 --> 00:21:59,679
environmental conditions that are on

629
00:22:03,750 --> 00:22:01,840
shuttle on orbit and we're trying to

630
00:22:06,230 --> 00:22:03,760
replicate those in an incubator here at

631
00:22:08,070 --> 00:22:06,240
the slsl in real time

632
00:22:10,549 --> 00:22:08,080
and it's the exact same samples that we

633
00:22:12,950 --> 00:22:10,559
delivered to nasa that were then took

634
00:22:13,830 --> 00:22:12,960
and and placed inside of the shuttle

635
00:22:15,909 --> 00:22:13,840
mission

636
00:22:18,070 --> 00:22:15,919
and right when it's activated we

637
00:22:20,230 --> 00:22:18,080
activate exactly the same time and we

638
00:22:22,230 --> 00:22:20,240

try to replicate those two

639

00:22:24,549 --> 00:22:22,240

in concert and then when they bring them

640

00:22:26,710 --> 00:22:24,559

back think about it as that barcode that

641

00:22:28,470 --> 00:22:26,720

you always see on csi that they're

642

00:22:30,549 --> 00:22:28,480

always looking at the dna barcode and it

643

00:22:31,830 --> 00:22:30,559

comes and it leaps and this one doesn't

644

00:22:33,990 --> 00:22:31,840

down here

645

00:22:36,870 --> 00:22:34,000

and then they say there you go and they

646

00:22:39,190 --> 00:22:36,880

ended up coming down to where they

647

00:22:40,950 --> 00:22:39,200

get a a tighter

648

00:22:42,230 --> 00:22:40,960

area now let's say that you're not

649

00:22:43,830 --> 00:22:42,240

talking about the telephone numbers of

650

00:22:45,350 --> 00:22:43,840

the world you might be thinking about

651
00:22:47,909 --> 00:22:45,360
the telephone numbers of the united

652
00:22:51,909 --> 00:22:47,919
states and then they fly again with

653
00:22:55,110 --> 00:22:51,919
those and they genetically with enzymes

654
00:22:56,549 --> 00:22:55,120
parse out those and they then fly those

655
00:22:58,390 --> 00:22:56,559
up the next time

656
00:22:59,350 --> 00:22:58,400
so the first one we call our survey

657
00:23:02,070 --> 00:22:59,360
flights

658
00:23:04,390 --> 00:23:02,080
and the second ones we call are

659
00:23:06,390 --> 00:23:04,400
expression flights and then we start

660
00:23:07,669 --> 00:23:06,400
feeding them to a little animal called a

661
00:23:09,830 --> 00:23:07,679
c elegans

662
00:23:12,789 --> 00:23:09,840
that the brilliant people in germany at

663
00:23:15,029 --> 00:23:12,799

max blank have developed that axe looks

664

00:23:17,430 --> 00:23:15,039

and operates a lot like you and me

665

00:23:20,230 --> 00:23:17,440

although they're microscopic worms they

666

00:23:22,950 --> 00:23:20,240

can tell whether the immune system is in

667

00:23:25,510 --> 00:23:22,960

that worm elevated due to whatever

668

00:23:27,909 --> 00:23:25,520

selection of the strain of microbe that

669

00:23:30,470 --> 00:23:27,919

they've chosen to express against it and

670

00:23:32,390 --> 00:23:30,480

they also know if it kills it and that

671

00:23:34,710 --> 00:23:32,400

this genetically designed little c

672

00:23:35,669 --> 00:23:34,720

elegan worm is designed to act like you

673

00:23:37,350 --> 00:23:35,679

and me

674

00:23:39,190 --> 00:23:37,360

so when they bring them back then they

675

00:23:41,750 --> 00:23:39,200

know now

676
00:23:43,350 --> 00:23:41,760
a smaller area we're getting down to the

677
00:23:45,029 --> 00:23:43,360
the state of florida

678
00:23:46,950 --> 00:23:45,039
and then finally we get down to cocoa

679
00:23:49,590 --> 00:23:46,960
beach and finally we get to

680
00:23:52,149 --> 00:23:49,600
exactly where we are today with the

681
00:23:53,510 --> 00:23:52,159
number that we need in order to develop

682
00:23:54,549 --> 00:23:53,520
the vaccines

683
00:23:57,029 --> 00:23:54,559
and

684
00:23:58,950 --> 00:23:57,039
it's a long process it takes four or

685
00:24:00,549 --> 00:23:58,960
five missions to do

686
00:24:03,190 --> 00:24:00,559
but before

687
00:24:04,789 --> 00:24:03,200
and when nasa would fly science in in

688
00:24:06,310 --> 00:24:04,799

the previous ways that they would do it

689

00:24:07,830 --> 00:24:06,320

it would be in fits and starts and it

690

00:24:09,510 --> 00:24:07,840

was one of the criticisms that the

691

00:24:11,590 --> 00:24:09,520

scientists always

692

00:24:13,590 --> 00:24:11,600

brought up as far as

693

00:24:16,149 --> 00:24:13,600

as far as nasa and their sciences they

694

00:24:17,830 --> 00:24:16,159

weren't consistent and they weren't

695

00:24:21,669 --> 00:24:17,840

frequent enough

696

00:24:24,230 --> 00:24:21,679

to sustain a good scientific model

697

00:24:25,190 --> 00:24:24,240

we with nasa's encouragement in this

698

00:24:27,029 --> 00:24:25,200

case because they knew they were

699

00:24:28,630 --> 00:24:27,039

completing the station and they knew

700

00:24:31,510 --> 00:24:28,640

that it was time that the construction

701
00:24:34,390 --> 00:24:31,520
was over with it was drawing to an end

702
00:24:36,549 --> 00:24:34,400
and these guys have been incredible

703
00:24:39,190 --> 00:24:36,559
in terms of what they've done to bend

704
00:24:42,390 --> 00:24:39,200
over backwards to put our science on on

705
00:24:44,710 --> 00:24:42,400
the shuttles and to just you have no

706
00:24:47,590 --> 00:24:44,720
idea what it's what what it's been

707
00:24:50,070 --> 00:24:47,600
to get there from uh and it's really

708
00:24:52,390 --> 00:24:50,080
it's nasa i mean we've done our part but

709
00:24:56,149 --> 00:24:52,400
we were going to do our part anyway

710
00:24:58,390 --> 00:24:56,159
it was nasa this time who said

711
00:25:00,230 --> 00:24:58,400
before yes we're in fits and starts but

712
00:25:02,070 --> 00:25:00,240
we were constructing a skyscraper in

713
00:25:04,470 --> 00:25:02,080

space give us a break and they were

714

00:25:06,789 --> 00:25:04,480

right about that frankly in in my

715

00:25:09,510 --> 00:25:06,799

analysis and then they said we're about

716

00:25:11,110 --> 00:25:09,520

to complete this hey let's do everything

717

00:25:14,310 --> 00:25:11,120

we can in order to fly these as

718

00:25:17,110 --> 00:25:14,320

consistently as possible and we all work

719

00:25:18,630 --> 00:25:17,120

together in absolute beautiful harmony

720

00:25:20,230 --> 00:25:18,640

i've never seen anything quite like it

721

00:25:23,269 --> 00:25:20,240

in anything i've ever done

722

00:25:24,950 --> 00:25:23,279

and the results are now we have a

723

00:25:27,430 --> 00:25:24,960

vaccine that we're moving through fda

724

00:25:28,950 --> 00:25:27,440

for salmonella and while salmonella is

725

00:25:30,310 --> 00:25:28,960

not the most valuable vaccine in the

726

00:25:33,269 --> 00:25:30,320

world because it typically doesn't kill

727

00:25:35,110 --> 00:25:33,279

people in the in the developed world um

728

00:25:37,430 --> 00:25:35,120

it is a valuable vaccine in the third

729

00:25:39,830 --> 00:25:37,440

world but we did it because there was a

730

00:25:42,789 --> 00:25:39,840

lot of previous work that had been done

731

00:25:44,470 --> 00:25:42,799

and that uh we kind of as nasa had

732

00:25:46,230 --> 00:25:44,480

already flown two flights before it so

733

00:25:47,909 --> 00:25:46,240

we had a little head start but the more

734

00:25:49,590 --> 00:25:47,919

important part about about salmonella

735

00:25:51,830 --> 00:25:49,600

was is we knew it was safe it wasn't

736

00:25:53,990 --> 00:25:51,840

going to kill the astronauts if they got

737

00:25:56,549 --> 00:25:54,000

it if it got loose so we got all of that

738

00:25:59,269 --> 00:25:56,559

put down safety and review

739

00:26:00,870 --> 00:25:59,279

at nasa the hardware all of our systems

740

00:26:02,470 --> 00:26:00,880

and we now have what we call amp which

741

00:26:04,630 --> 00:26:02,480

is the astrogenetic microgravity

742

00:26:07,110 --> 00:26:04,640

processing platform and that's all

743

00:26:09,110 --> 00:26:07,120

documented with manuals and it's got a

744

00:26:11,190 --> 00:26:09,120

lot of work that has been done on that

745

00:26:12,950 --> 00:26:11,200

so we now have a proven platform and now

746

00:26:14,710 --> 00:26:12,960

we're sending up mrsa we're on our

747

00:26:17,510 --> 00:26:14,720

fourth flight on orbit right now i'm

748

00:26:20,070 --> 00:26:17,520

excited to say for mrsa

749

00:26:21,990 --> 00:26:20,080

that kills people that's a big deal

750

00:26:23,990 --> 00:26:22,000

that's bringing our healthcare system in

751
00:26:25,750 --> 00:26:24,000
the hospitals down through their knees

752
00:26:28,630 --> 00:26:25,760
the lawyers are all over it they're

753
00:26:31,110 --> 00:26:28,640
suing hospitals and they're they're

754
00:26:32,390 --> 00:26:31,120
getting massive massive judgments on

755
00:26:34,789 --> 00:26:32,400
those and

756
00:26:36,390 --> 00:26:34,799
uh and it's it's not good and it's not

757
00:26:38,470 --> 00:26:36,400
it's not just the united states hospital

758
00:26:40,310 --> 00:26:38,480
system either it's all the developed

759
00:26:43,110 --> 00:26:40,320
world and really the whole world is is

760
00:26:45,669 --> 00:26:43,120
experiencing the the faults of mrsa is

761
00:26:48,310 --> 00:26:45,679
that that staff that hospital staff is

762
00:26:50,390 --> 00:26:48,320
normally called it is tough stuff

763
00:26:52,149 --> 00:26:50,400

and if we can get a vaccine for that the

764

00:26:54,870 --> 00:26:52,159

very first thing we'll do is we'll try

765

00:26:56,230 --> 00:26:54,880

to get the hospital personnel vaccinated

766

00:26:58,149 --> 00:26:56,240

because those are the ones that are the

767

00:26:59,990 --> 00:26:58,159

carriers of it and that's the beginning

768

00:27:01,830 --> 00:27:00,000

just like in polio the first thing to do

769

00:27:03,750 --> 00:27:01,840

was to go get the healthcare workers and

770

00:27:06,230 --> 00:27:03,760

get them vaccinated and then everything

771

00:27:08,149 --> 00:27:06,240

else fell in line after that so that's

772

00:27:10,230 --> 00:27:08,159

the process that we're in that's what

773

00:27:12,149 --> 00:27:10,240

we're doing right now we chose the

774

00:27:14,470 --> 00:27:12,159

microbes because we knew that we only

775

00:27:16,390 --> 00:27:14,480

had two weeks sorties to fly them on you

776

00:27:18,710 --> 00:27:16,400

only need about six days to process

777

00:27:19,590 --> 00:27:18,720

under amp for these microbes to do their

778

00:27:22,630 --> 00:27:19,600

thing

779

00:27:24,549 --> 00:27:22,640

and the pcgs we feel like you need a lot

780

00:27:26,630 --> 00:27:24,559

longer around three months you have to

781

00:27:29,269 --> 00:27:26,640

have sustained microgravity on a quiet

782

00:27:32,230 --> 00:27:29,279

station for pcgs for protein crystals

783

00:27:34,070 --> 00:27:32,240

and it's not quiet you have kibo modules

784

00:27:36,470 --> 00:27:34,080

coming in and hammering into it and you

785

00:27:38,389 --> 00:27:36,480

have all kinds of things and we have mrm

786

00:27:40,789 --> 00:27:38,399

one that astrotech is is right now

787

00:27:43,990 --> 00:27:40,799

processing and it'll be slamming into it

788

00:27:45,990 --> 00:27:44,000

in uh in may and so that's not where you

789

00:27:48,310 --> 00:27:46,000

want to be growing but we can isolate we

790

00:27:50,310 --> 00:27:48,320

do isolate we do have racks that isolate

791

00:27:51,750 --> 00:27:50,320

the isolation technology that i've

792

00:27:53,669 --> 00:27:51,760

looked at i've not been particularly

793

00:27:56,230 --> 00:27:53,679

impressed with it has dampening on it

794

00:27:58,549 --> 00:27:56,240

and it has a dampening process that

795

00:28:01,110 --> 00:27:58,559

tries to um

796

00:28:03,190 --> 00:28:01,120

uh you know try it tries to somehow or

797

00:28:06,149 --> 00:28:03,200

another look at where it's going to have

798

00:28:08,470 --> 00:28:06,159

to dampen into and i'm i'm not impressed

799

00:28:09,669 --> 00:28:08,480

with the results of that not to say that

800

00:28:11,190 --> 00:28:09,679

it's all new

801
00:28:12,710 --> 00:28:11,200
i mean this is you know things that were

802
00:28:15,190 --> 00:28:12,720
being done while you're constructing a

803
00:28:17,430 --> 00:28:15,200
station yeah but if an astronaut gets on

804
00:28:18,389 --> 00:28:17,440
the treadmill is that a problem that's a

805
00:28:21,750 --> 00:28:18,399
problem

806
00:28:23,830 --> 00:28:21,760
have like it just you know like mike

807
00:28:25,669 --> 00:28:23,840
says you can put dampening in there but

808
00:28:27,669 --> 00:28:25,679
not where you have things slamming into

809
00:28:29,909 --> 00:28:27,679
it it vibrates for 45 minutes and things

810
00:28:31,190 --> 00:28:29,919
like that that does actually happen

811
00:28:35,430 --> 00:28:31,200
that you're trying to get away from well

812
00:28:38,389 --> 00:28:36,950
maybe it's a high class problem we'll

813
00:28:39,909 --> 00:28:38,399

figure it out

814

00:28:43,110 --> 00:28:39,919

but anyway let me roll this really we

815

00:28:45,269 --> 00:28:43,120

may not even might need another wing

816

00:28:47,510 --> 00:28:45,279

so here we have real quick uh it is a

817

00:28:49,909 --> 00:28:47,520

national laboratory uh which is a big

818

00:28:52,789 --> 00:28:49,919

deal that allows commercial operations

819

00:28:55,430 --> 00:28:52,799

to come into and and provide and produce

820

00:28:58,070 --> 00:28:55,440

commercial pro products in space to sell

821

00:28:59,430 --> 00:28:58,080

on earth on a government facility and

822

00:29:01,590 --> 00:28:59,440

there's lots of national labs all over

823

00:29:02,789 --> 00:29:01,600

the country santia los alamos there's

824

00:29:05,110 --> 00:29:02,799

plenty of them but now we have one in

825

00:29:08,389 --> 00:29:05,120

space at 220 miles up

826

00:29:09,909 --> 00:29:08,399

and uh and advantages of microgravity as

827

00:29:11,990 --> 00:29:09,919

growth within the space environment

828

00:29:14,389 --> 00:29:12,000

induces valuable changes in microbial

829

00:29:17,510 --> 00:29:14,399

cells that i'm not going to give excuses

830

00:29:19,590 --> 00:29:17,520

as to why only to tell you it works

831

00:29:21,590 --> 00:29:19,600

commercial value is that we get the

832

00:29:23,669 --> 00:29:21,600

growth rate and size resistance to drug

833

00:29:25,110 --> 00:29:23,679

treatments and virulence and then we see

834

00:29:27,269 --> 00:29:25,120

vaccines and therapeutics now

835

00:29:29,269 --> 00:29:27,279

therapeutics i did not talk a lot about

836

00:29:31,269 --> 00:29:29,279

but that's where you take the vaccines

837

00:29:33,510 --> 00:29:31,279

and then if you have mrsa and you've

838

00:29:36,389 --> 00:29:33,520

already got it now what

839

00:29:38,149 --> 00:29:36,399

and it's these uh antibiotics that don't

840

00:29:41,909 --> 00:29:38,159

work because this thing's always

841

00:29:43,990 --> 00:29:41,919

morphing around and it's such a clever

842

00:29:46,310 --> 00:29:44,000

little microbe that it seems to be

843

00:29:47,909 --> 00:29:46,320

incredibly infectious and

844

00:29:50,549 --> 00:29:47,919

certainly looks after itself that's for

845

00:29:52,630 --> 00:29:50,559

sure well we can also move towards and

846

00:29:53,830 --> 00:29:52,640

from the vaccines and go into actually a

847

00:29:55,750 --> 00:29:53,840

therapeutic that we can apply

848

00:29:56,950 --> 00:29:55,760

topographically to the infection and

849

00:29:58,470 --> 00:29:56,960

then it will end up killing the

850

00:30:01,110 --> 00:29:58,480

infection which is super important as

851
00:30:03,430 --> 00:30:01,120
well and very valuable next slide please

852
00:30:05,190 --> 00:30:03,440
here are our flights and i wanted to put

853
00:30:07,510 --> 00:30:05,200
it in that presentation right there to

854
00:30:10,710 --> 00:30:07,520
show you what we've been doing and how

855
00:30:12,870 --> 00:30:10,720
consistent it is and again hats off to

856
00:30:14,310 --> 00:30:12,880
everyone i love at nasa i can't tell you

857
00:30:16,789 --> 00:30:14,320
how much i love them

858
00:30:19,190 --> 00:30:16,799
and that's the reason why is right there

859
00:30:21,990 --> 00:30:19,200
there is the performance of it and

860
00:30:23,430 --> 00:30:22,000
uh you know they've just done a superb

861
00:30:25,029 --> 00:30:23,440
job here you will see salmonella

862
00:30:27,190 --> 00:30:25,039
salmonella salmonella there had already

863
00:30:29,190 --> 00:30:27,200

been two of them before that then we

864

00:30:31,430 --> 00:30:29,200

moved off of savinelli we went on to

865

00:30:32,950 --> 00:30:31,440

mrsa it was our survey flight all we

866

00:30:34,470 --> 00:30:32,960

need is one gap and you'll see what a

867

00:30:35,510 --> 00:30:34,480

gap is here in a second is our piece of

868

00:30:38,149 --> 00:30:35,520

hardware

869

00:30:39,990 --> 00:30:38,159

and uh and so we flew a whole lot of

870

00:30:41,750 --> 00:30:40,000

others to fill up our pipeline that you

871

00:30:43,029 --> 00:30:41,760

see there

872

00:30:44,470 --> 00:30:43,039

by and large those are infectious

873

00:30:46,710 --> 00:30:44,480

diseases

874

00:30:48,710 --> 00:30:46,720

and then we went back to mrsa once we

875

00:30:50,389 --> 00:30:48,720

found uh you know as i said the

876
00:30:52,389 --> 00:30:50,399
telephone book of the world got down to

877
00:30:53,909 --> 00:30:52,399
the telephone book of america and we

878
00:30:56,310 --> 00:30:53,919
started flying them and trying to get

879
00:30:57,590 --> 00:30:56,320
down to where we are today and we're

880
00:31:00,710 --> 00:30:57,600
very hopeful for the flight that we have

881
00:31:02,870 --> 00:31:00,720
on orbit today next slide please

882
00:31:05,509 --> 00:31:02,880
uh vaccine targets have been identified

883
00:31:06,549 --> 00:31:05,519
we're moving through fda god if you you

884
00:31:07,990 --> 00:31:06,559
know

885
00:31:09,269 --> 00:31:08,000
it's one thing to fly to space it's

886
00:31:10,870 --> 00:31:09,279
another thing to get through fda it's

887
00:31:12,950 --> 00:31:10,880
okay

888
00:31:14,470 --> 00:31:12,960

i mean i know i mean i've read things

889

00:31:15,669 --> 00:31:14,480

you know in financial magazines and

890

00:31:17,029 --> 00:31:15,679

things like that that talk about how

891

00:31:19,669 --> 00:31:17,039

tough it is to get through the fda but

892

00:31:21,509 --> 00:31:19,679

man when you're in it

893

00:31:23,590 --> 00:31:21,519

it's it's something else

894

00:31:24,710 --> 00:31:23,600

uh mrsa virulence targets have been

895

00:31:28,630 --> 00:31:24,720

identified and are currently being

896

00:31:30,389 --> 00:31:28,640

validated on 131 next please

897

00:31:32,870 --> 00:31:30,399

here's a little movie that shows

898

00:31:33,909 --> 00:31:32,880

this is nicole stott and and cj strzok

899

00:31:36,230 --> 00:31:33,919

that's right

900

00:31:37,990 --> 00:31:36,240

and um

901
00:31:40,630 --> 00:31:38,000
they're just twisting something it's

902
00:31:43,029 --> 00:31:40,640
very low tech in that way or as i say

903
00:31:44,950 --> 00:31:43,039
it's kind of fail proof i did this on on

904
00:31:46,630 --> 00:31:44,960
expedition eight did you yeah

905
00:31:48,950 --> 00:31:46,640
then you had probably that's those first

906
00:31:50,950 --> 00:31:48,960
salmonella flies this is what's going on

907
00:31:53,430 --> 00:31:50,960
inside of it this is how the microbes

908
00:31:55,430 --> 00:31:53,440
are eating and now we introduce the uh

909
00:31:57,269 --> 00:31:55,440
the c elegans in there and they come in

910
00:31:58,310 --> 00:31:57,279
and eat those microbes that are fully

911
00:32:00,149 --> 00:31:58,320
developed

912
00:32:01,190 --> 00:32:00,159
and then we bring and we kill them at

913
00:32:02,630 --> 00:32:01,200

the end

914

00:32:04,070 --> 00:32:02,640
and then we well which is perfect

915

00:32:05,350 --> 00:32:04,080
because on re-entry i don't care how i

916

00:32:08,070 --> 00:32:05,360
come in i don't have to have a safe

917

00:32:10,870 --> 00:32:08,080
re-entry you know the protein crystals

918

00:32:12,710 --> 00:32:10,880
might get shattered you know so anyway

919

00:32:14,630 --> 00:32:12,720
next slide please

920

00:32:16,070 --> 00:32:14,640
uh and so we have seven additional

921

00:32:17,590 --> 00:32:16,080
microbes that have been conducted and

922

00:32:18,950 --> 00:32:17,600
manifested for future flights those are

923

00:32:21,430 --> 00:32:18,960
the ones that we flew earlier and we

924

00:32:24,549 --> 00:32:21,440
intend to start up again after mrsa

925

00:32:26,470 --> 00:32:24,559
and then uh the protein crystals

926

00:32:28,310 --> 00:32:26,480

you know i got to tell you it you know

927

00:32:30,789 --> 00:32:28,320

the microbes are great and infectious

928

00:32:33,029 --> 00:32:30,799

diseases are wonderful in mrsa i'd love

929

00:32:34,789 --> 00:32:33,039

to solve but when you get into the

930

00:32:36,470 --> 00:32:34,799

protein crystals there's two types

931

00:32:38,549 --> 00:32:36,480

there's called an aqueous and a membrane

932

00:32:40,470 --> 00:32:38,559

protein and the aqueous proteins are

933

00:32:42,470 --> 00:32:40,480

kind of big plump and big

934

00:32:44,310 --> 00:32:42,480

and they're the ones that you're seeing

935

00:32:46,710 --> 00:32:44,320

a lot of lead compounds being developed

936

00:32:48,470 --> 00:32:46,720

for uh now but when you get into the

937

00:32:50,950 --> 00:32:48,480

membrane proteins like parkinson's and

938

00:32:52,710 --> 00:32:50,960

alzheimer's that's the real stuff that's

939

00:32:55,029 --> 00:32:52,720

really really hard to do and you have to

940

00:32:57,350 --> 00:32:55,039

have extremely pure crystals in order to

941

00:32:59,110 --> 00:32:57,360

get that done and it's just like a

942

00:33:01,430 --> 00:32:59,120

crystal you have in your refrigerator

943

00:33:03,750 --> 00:33:01,440

every day you go in and look at and it

944

00:33:06,230 --> 00:33:03,760

is an ice cube and it's very cloudy

945

00:33:07,830 --> 00:33:06,240

that's gravity that's that's having an

946

00:33:11,029 --> 00:33:07,840

impact on the formation of those

947

00:33:13,430 --> 00:33:11,039

crystals if you send that same ice cube

948

00:33:15,190 --> 00:33:13,440

up to space and grow it it's perfectly

949

00:33:17,190 --> 00:33:15,200

clear and i think you'll see they're

950

00:33:18,470 --> 00:33:17,200

perfectly clear it's the same thing for

951
00:33:20,470 --> 00:33:18,480
the crystals that they grow around the

952
00:33:22,789 --> 00:33:20,480
proteins they got to grow the proteins

953
00:33:24,789 --> 00:33:22,799
around the or grow the crystals around

954
00:33:26,950 --> 00:33:24,799
the proteins and then they refract it

955
00:33:29,269 --> 00:33:26,960
with an x-ray and then they can find

956
00:33:31,110 --> 00:33:29,279
what the atoms are and you got to know

957
00:33:34,470 --> 00:33:31,120
exactly what the atoms are in that

958
00:33:36,549 --> 00:33:34,480
protein you can't be off by one hydrogen

959
00:33:39,190 --> 00:33:36,559
atom or else you will not be able to

960
00:33:40,950 --> 00:33:39,200
connect or control that protein and

961
00:33:43,029 --> 00:33:40,960
you've got to have every advantage to

962
00:33:45,669 --> 00:33:43,039
you in that game every advantage you can

963
00:33:47,830 --> 00:33:45,679

imagine and sending them up to space has

964

00:33:49,750 --> 00:33:47,840

already proven to be very advantageous

965

00:33:51,029 --> 00:33:49,760

in growing those proteins and i believe

966

00:33:53,909 --> 00:33:51,039

it's the only way that we're going to

967

00:33:55,669 --> 00:33:53,919

end up ever solving these more sinister

968

00:33:57,269 --> 00:33:55,679

diseases of parkinson's and alzheimer's

969

00:33:59,190 --> 00:33:57,279

and aids and these really really nasty

970

00:34:00,630 --> 00:33:59,200

stuff they've tried them they tried and

971

00:34:02,470 --> 00:34:00,640

they've tried and they'd throw billions

972

00:34:04,310 --> 00:34:02,480

of dollars at it and they haven't got

973

00:34:06,470 --> 00:34:04,320

anywhere in those except for maybe

974

00:34:08,069 --> 00:34:06,480

treatments it's a big difference between

975

00:34:10,149 --> 00:34:08,079

treatments and cures

976
00:34:11,109 --> 00:34:10,159
so maybe we go to treatments here but i

977
00:34:12,869 --> 00:34:11,119
don't believe that you're going to get

978
00:34:13,750 --> 00:34:12,879
there in any other way than flying to

979
00:34:17,109 --> 00:34:13,760
space

980
00:34:21,109 --> 00:34:18,710
these are these racks that we have on

981
00:34:22,790 --> 00:34:21,119
station we in our barter agreement with

982
00:34:25,030 --> 00:34:22,800
the international partners every time we

983
00:34:27,109 --> 00:34:25,040
flew a module or a segment

984
00:34:28,629 --> 00:34:27,119
we got half of those racks as long as

985
00:34:30,550 --> 00:34:28,639
they flew in our shuttle then we got

986
00:34:33,190 --> 00:34:30,560
half of the racks or access to them the

987
00:34:35,589 --> 00:34:33,200
the us did we have a lot of racks and we

988
00:34:37,190 --> 00:34:35,599

can fill them up in my opinion with a

989

00:34:38,950 --> 00:34:37,200

lot of experiments a lot of basic

990

00:34:40,710 --> 00:34:38,960

science that i'm not going to do i'm

991

00:34:44,310 --> 00:34:40,720

going to hopefully

992

00:34:46,149 --> 00:34:44,320

expect maybe the nih to do it or for nsf

993

00:34:48,470 --> 00:34:46,159

to do it or for the ag department to do

994

00:34:50,310 --> 00:34:48,480

it or for the university system to do it

995

00:34:51,829 --> 00:34:50,320

that's what they should do but they

996

00:34:53,190 --> 00:34:51,839

should be filling up those racks and i

997

00:34:55,030 --> 00:34:53,200

should be filling up those racks and

998

00:34:56,149 --> 00:34:55,040

anybody else that has an opportunity

999

00:34:58,069 --> 00:34:56,159

should be filling them up too because

1000

00:35:01,109 --> 00:34:58,079

it's a magnificent laboratory and it's

1001

00:35:02,870 --> 00:35:01,119

al it's ours and it's completed as of

1002

00:35:04,150 --> 00:35:02,880

the end of this year it's super exciting

1003

00:35:06,310 --> 00:35:04,160

the most exciting thing i've ever worked

1004

00:35:08,470 --> 00:35:06,320

on in my life period so the station has

1005

00:35:10,069 --> 00:35:08,480

a nice rack huh good that's good good to

1006

00:35:11,510 --> 00:35:10,079

hear all right so that's the slide

1007

00:35:13,349 --> 00:35:11,520

that's oh you're still going i'm sorry

1008

00:35:15,190 --> 00:35:13,359

that's it i just wanted to end up with

1009

00:35:16,710 --> 00:35:15,200

making medicines in space to save lives

1010

00:35:18,950 --> 00:35:16,720

on earth all right so

1011

00:35:22,630 --> 00:35:18,960

wow

1012

00:35:25,109 --> 00:35:22,640

okay it's just the web right yeah

1013

00:35:27,109 --> 00:35:25,119

all right so uh brent alexander uh is uh

1014

00:35:28,310 --> 00:35:27,119

believe you you were very instrumental

1015

00:35:29,990 --> 00:35:28,320

and i don't know where you're starting

1016

00:35:31,430 --> 00:35:30,000

off but i hope you address this you were

1017

00:35:34,069 --> 00:35:31,440

very instrumental with the the vision

1018

00:35:35,750 --> 00:35:34,079

for space exploration which um did not

1019

00:35:37,589 --> 00:35:35,760

turn out the way you expected i'm

1020

00:35:39,670 --> 00:35:37,599

curious you know how you feel about that

1021

00:35:41,990 --> 00:35:39,680

and where we are today well yeah thank

1022

00:35:43,750 --> 00:35:42,000

you miles i'm going to talk about how we

1023

00:35:46,069 --> 00:35:43,760

get to the space station what the

1024

00:35:47,510 --> 00:35:46,079

president's proposal i think the the the

1025

00:35:49,750 --> 00:35:47,520

piece of it that i

1026

00:35:51,829 --> 00:35:49,760

uh am most excited about

1027

00:35:53,109 --> 00:35:51,839

is changing how we get into space it's

1028

00:35:55,190 --> 00:35:53,119

changing from government developed

1029

00:35:57,270 --> 00:35:55,200

systems to privately developed systems

1030

00:35:59,910 --> 00:35:57,280

with government safety oversight and

1031

00:36:01,750 --> 00:35:59,920

that sounds very mechanical and and not

1032

00:36:03,190 --> 00:36:01,760

very interesting but what it does is

1033

00:36:05,910 --> 00:36:03,200

really change

1034

00:36:08,069 --> 00:36:05,920

uh the dynamics and the economics of

1035

00:36:10,950 --> 00:36:08,079

getting into space such that we have a

1036

00:36:12,550 --> 00:36:10,960

much more uh robust capability to not

1037

00:36:14,150 --> 00:36:12,560

only get more people into space like

1038

00:36:15,910 --> 00:36:14,160

like mike was talking about to the space

1039

00:36:17,910 --> 00:36:15,920

station but also to do all the great

1040

00:36:21,270 --> 00:36:17,920

research that tom's talking about and

1041

00:36:23,349 --> 00:36:21,280

tom i know uh firsthand the value of a

1042

00:36:25,270 --> 00:36:23,359

salmonella vaccine my daughter when she

1043

00:36:28,230 --> 00:36:25,280

was four years old had salmonella

1044

00:36:29,910 --> 00:36:28,240

poisoning and that is a painful ugly

1045

00:36:32,390 --> 00:36:29,920

horrible thing

1046

00:36:34,950 --> 00:36:32,400

and and and so certainly the value for

1047

00:36:36,069 --> 00:36:34,960

that uh would be tremendous worldwide so

1048

00:36:38,829 --> 00:36:36,079

i thank you for doing that kind of

1049

00:36:43,349 --> 00:36:41,589

so talking about the the benefits of

1050

00:36:45,030 --> 00:36:43,359

this new approach

1051

00:36:46,630 --> 00:36:45,040

really i think

1052

00:36:49,030 --> 00:36:46,640

looking first if i if i go to the next

1053

00:36:50,150 --> 00:36:49,040

slide please uh there are benefits to

1054

00:36:51,750 --> 00:36:50,160

nasa

1055

00:36:53,589 --> 00:36:51,760

i want to move quickly to the benefits

1056

00:36:54,390 --> 00:36:53,599

to the nation but the benefits to nasa

1057

00:36:55,910 --> 00:36:54,400

are

1058

00:36:58,550 --> 00:36:55,920

freeing up nasa resources for

1059

00:37:00,150 --> 00:36:58,560

exploration because focusing on just

1060

00:37:02,230 --> 00:37:00,160

getting to the space station and using

1061

00:37:04,390 --> 00:37:02,240

privately developed systems to get there

1062

00:37:06,390 --> 00:37:04,400

it's a simpler mission than going beyond

1063

00:37:08,630 --> 00:37:06,400

so you free up nasa resources so that

1064

00:37:11,430 --> 00:37:08,640

nasa can focus on going beyond

1065

00:37:12,710 --> 00:37:11,440

to the moon lagrange points mars moons

1066

00:37:15,430 --> 00:37:12,720

of mars

1067

00:37:17,109 --> 00:37:15,440

while industry focuses on getting to low

1068

00:37:19,030 --> 00:37:17,119

earth orbit having that redundant access

1069

00:37:21,030 --> 00:37:19,040

that mike talked about

1070

00:37:23,270 --> 00:37:21,040

closing the gap because it's a simpler

1071

00:37:24,550 --> 00:37:23,280

mission it can be done sooner not

1072

00:37:27,109 --> 00:37:24,560

because

1073

00:37:29,030 --> 00:37:27,119

industry is particularly faster than

1074

00:37:30,870 --> 00:37:29,040

government although some may argue that

1075

00:37:32,230 --> 00:37:30,880

and i believe that certainly to be true

1076
00:37:33,910 --> 00:37:32,240
but the mission is simpler and we can

1077
00:37:35,829 --> 00:37:33,920
get there faster

1078
00:37:37,670 --> 00:37:35,839
by just focusing on that

1079
00:37:39,109 --> 00:37:37,680
lower costs and really unlocking the

1080
00:37:40,950 --> 00:37:39,119
potential of the space station getting

1081
00:37:43,349 --> 00:37:40,960
more people and more experiments up

1082
00:37:45,270 --> 00:37:43,359
there next chart please

1083
00:37:48,470 --> 00:37:45,280
the benefits to the nation

1084
00:37:50,550 --> 00:37:48,480
are as we do that we open up a whole new

1085
00:37:52,470 --> 00:37:50,560
economic system or a whole new net

1086
00:37:53,990 --> 00:37:52,480
economic realm to do all sorts of

1087
00:37:57,430 --> 00:37:54,000
different things getting private people

1088
00:37:58,950 --> 00:37:57,440

into space private companies into space

1089

00:38:00,790 --> 00:37:58,960

and and not just government civil

1090

00:38:02,470 --> 00:38:00,800

servants flying we're going to have a

1091

00:38:03,589 --> 00:38:02,480

lot more activity and it's the private

1092

00:38:05,030 --> 00:38:03,599

sector that comes up with these

1093

00:38:06,390 --> 00:38:05,040

innovations and really can drive the

1094

00:38:09,270 --> 00:38:06,400

economy of this

1095

00:38:10,950 --> 00:38:09,280

nasa then 20 30 years from now will be

1096

00:38:11,829 --> 00:38:10,960

looking back on a system where they are

1097

00:38:13,829 --> 00:38:11,839

really

1098

00:38:15,589 --> 00:38:13,839

enabled in their exploration because

1099

00:38:18,150 --> 00:38:15,599

there's so much other activity in space

1100

00:38:20,069 --> 00:38:18,160

and it's not all up to the government

1101

00:38:21,829 --> 00:38:20,079

it's economic competitiveness new

1102

00:38:24,950 --> 00:38:21,839

industries and a space program for

1103

00:38:26,790 --> 00:38:24,960

everyone right right now

1104

00:38:28,390 --> 00:38:26,800

only government civil servants get to

1105

00:38:30,470 --> 00:38:28,400

fly in space and you gotta train for a

1106

00:38:32,310 --> 00:38:30,480

long long time and and you know if you

1107

00:38:34,390 --> 00:38:32,320

apply to the astronaut corps only the

1108

00:38:36,790 --> 00:38:34,400

very few and very lucky get to go very

1109

00:38:39,270 --> 00:38:36,800

good and very courageous people but it's

1110

00:38:40,470 --> 00:38:39,280

very very few people 35 americans

1111

00:38:41,910 --> 00:38:40,480

average

1112

00:38:44,069 --> 00:38:41,920

per year

1113

00:38:45,270 --> 00:38:44,079

five shuttle flights seven people per

1114

00:38:47,670 --> 00:38:45,280

flight

1115

00:38:48,950 --> 00:38:47,680

with the soyuz when we get rid of the

1116

00:38:50,550 --> 00:38:48,960

space shuttle for the soyuz we're going

1117

00:38:52,870 --> 00:38:50,560

to have six people going we're going to

1118

00:38:55,589 --> 00:38:52,880

be buying six seats on soyuz every year

1119

00:38:58,069 --> 00:38:55,599

that really 49 years after

1120

00:39:00,150 --> 00:38:58,079

alan shepard john glenn flew into space

1121

00:39:02,069 --> 00:39:00,160

we ought to be flying hundreds and

1122

00:39:03,829 --> 00:39:02,079

thousands of people every year and this

1123

00:39:05,109 --> 00:39:03,839

is the only change i think that'll get

1124

00:39:06,710 --> 00:39:05,119

us there

1125

00:39:09,670 --> 00:39:06,720

next chart please

1126
00:39:11,510 --> 00:39:09,680
so how are we going to do that

1127
00:39:12,829 --> 00:39:11,520
it's a new partnership

1128
00:39:16,150 --> 00:39:12,839
but it's not

1129
00:39:18,390 --> 00:39:16,160
a incredible change uh from where we've

1130
00:39:20,069 --> 00:39:18,400
been from an industry standpoint it is

1131
00:39:22,550 --> 00:39:20,079
u.s industry as the president said this

1132
00:39:25,670 --> 00:39:22,560
afternoon u.s industry has built every

1133
00:39:27,430 --> 00:39:25,680
spacecraft that americans have flown on

1134
00:39:29,829 --> 00:39:27,440
uh you know except for the russian

1135
00:39:32,069 --> 00:39:29,839
system so american systems have been

1136
00:39:34,310 --> 00:39:32,079
built by u.s industry

1137
00:39:36,470 --> 00:39:34,320
in partnership with nasa it's a change

1138
00:39:37,990 --> 00:39:36,480

in that partnership

1139

00:39:39,349 --> 00:39:38,000

that allows u.s industry to build

1140

00:39:41,910 --> 00:39:39,359

capabilities

1141

00:39:44,470 --> 00:39:41,920

fly them safely with nasa oversight and

1142

00:39:46,790 --> 00:39:44,480

open up these new markets

1143

00:39:48,950 --> 00:39:46,800

this you know it'll be develo systems

1144

00:39:50,390 --> 00:39:48,960

will be developed operated owned by the

1145

00:39:52,390 --> 00:39:50,400

private sector

1146

00:39:55,190 --> 00:39:52,400

they'll meet government needs

1147

00:39:57,030 --> 00:39:55,200

while enabling new markets

1148

00:39:58,550 --> 00:39:57,040

non-government uses

1149

00:40:00,870 --> 00:39:58,560

and most importantly you know a change

1150

00:40:03,589 --> 00:40:00,880

in the contractual mechanism from the

1151
00:40:05,030 --> 00:40:03,599
the cost plus uh sort of typical way we

1152
00:40:07,750 --> 00:40:05,040
have done uh

1153
00:40:10,630 --> 00:40:07,760
business with u.s industry to change to

1154
00:40:12,630 --> 00:40:10,640
a firm fixed price sort of

1155
00:40:14,950 --> 00:40:12,640
you know the

1156
00:40:18,309 --> 00:40:14,960
contractual model the way the the the

1157
00:40:20,069 --> 00:40:18,319
normal commercial sector works down

1158
00:40:21,670 --> 00:40:20,079
nasa will establish those safety

1159
00:40:24,550 --> 00:40:21,680
requirements the program requirements

1160
00:40:26,150 --> 00:40:24,560
how many people how many flights

1161
00:40:28,950 --> 00:40:26,160
how much water they take but also the

1162
00:40:30,150 --> 00:40:28,960
safety requirements for them

1163
00:40:31,910 --> 00:40:30,160

and

1164

00:40:34,309 --> 00:40:31,920

at the same time they won't be dictating

1165

00:40:36,069 --> 00:40:34,319

the specific design so allowing industry

1166

00:40:38,069 --> 00:40:36,079

to come up with in innovative ways to

1167

00:40:39,190 --> 00:40:38,079

meet those safety requirements it's

1168

00:40:41,109 --> 00:40:39,200

going to be key

1169

00:40:41,990 --> 00:40:41,119

and so nasa will be there every step of

1170

00:40:43,750 --> 00:40:42,000

the way

1171

00:40:45,829 --> 00:40:43,760

it's a big change and yet it's only a

1172

00:40:47,510 --> 00:40:45,839

small change in how we do things but it

1173

00:40:50,829 --> 00:40:47,520

unlocks the potential

1174

00:40:53,670 --> 00:40:50,839

for a lot more activity next chart

1175

00:40:55,430 --> 00:40:53,680

please so it's really about enabling new

1176
00:40:57,430 --> 00:40:55,440
markets if government's going to be the

1177
00:40:59,030 --> 00:40:57,440
only market forever and ever then we

1178
00:41:01,190 --> 00:40:59,040
might as well continue to do things the

1179
00:41:03,030 --> 00:41:01,200
same way they are now but what we're

1180
00:41:04,550 --> 00:41:03,040
really talking about is opening up new

1181
00:41:07,829 --> 00:41:04,560
markets now those new markets don't

1182
00:41:09,510 --> 00:41:07,839
exist today other than very small

1183
00:41:11,109 --> 00:41:09,520
it's not going to be in five years that

1184
00:41:12,790 --> 00:41:11,119
commercial is going to dominate but it's

1185
00:41:14,230 --> 00:41:12,800
going to be over the next 10 20 and 30

1186
00:41:16,390 --> 00:41:14,240
years that we're going to see this

1187
00:41:18,710 --> 00:41:16,400
change much the way we did in aviation

1188
00:41:21,430 --> 00:41:18,720

i'll talk about aviation in a moment

1189

00:41:23,510 --> 00:41:21,440

so nasa is going to dominate early on

1190

00:41:25,910 --> 00:41:23,520

but those other markets will come those

1191

00:41:27,829 --> 00:41:25,920

other markets include other governments

1192

00:41:29,670 --> 00:41:27,839

foreign governments that want to fly

1193

00:41:30,950 --> 00:41:29,680

people in space they see the potential

1194

00:41:33,589 --> 00:41:30,960

of space they want to unlock that

1195

00:41:35,109 --> 00:41:33,599

potential for their own purposes there's

1196

00:41:36,710 --> 00:41:35,119

national pride involved they also want

1197

00:41:38,950 --> 00:41:36,720

to train people so i think there's a

1198

00:41:41,750 --> 00:41:38,960

real market there near term for what we

1199

00:41:43,829 --> 00:41:41,760

would call other sovereign governments

1200

00:41:46,829 --> 00:41:43,839

businesses to exploit microgravity like

1201
00:41:49,990 --> 00:41:46,839
tom was talking about with astrogenetics

1202
00:41:51,510 --> 00:41:50,000
um other pharmaceutical companies other

1203
00:41:54,230 --> 00:41:51,520
activities in space

1204
00:41:56,470 --> 00:41:54,240
the uses today for the computer

1205
00:41:59,190 --> 00:41:56,480
uh you know are are things that we never

1206
00:42:00,790 --> 00:41:59,200
dreamed about and when the home computer

1207
00:42:03,430 --> 00:42:00,800
the personal computer was introduced in

1208
00:42:05,589 --> 00:42:03,440
the late 70s early 80s we could have

1209
00:42:07,349 --> 00:42:05,599
never dreamed that we'd have so much

1210
00:42:08,790 --> 00:42:07,359
computing power in our hands we take it

1211
00:42:10,470 --> 00:42:08,800
everywhere and we access the internet

1212
00:42:12,470 --> 00:42:10,480
all the time we can't live without these

1213
00:42:15,430 --> 00:42:12,480

things today and yet

1214

00:42:17,430 --> 00:42:15,440

they were unheard of not even thought of

1215

00:42:19,589 --> 00:42:17,440

long after even

1216

00:42:21,430 --> 00:42:19,599

we had landed on the moon so everything

1217

00:42:23,589 --> 00:42:21,440

has changed in some worlds and not much

1218

00:42:26,710 --> 00:42:23,599

has changed in other markets

1219

00:42:29,190 --> 00:42:26,720

and time is is now to to start here so

1220

00:42:32,069 --> 00:42:29,200

the payback then to u.s leadership in

1221

00:42:35,030 --> 00:42:32,079

space uh to the economy

1222

00:42:37,510 --> 00:42:35,040

uh you know into to developing

1223

00:42:39,270 --> 00:42:37,520

better safer systems to flying

1224

00:42:41,670 --> 00:42:39,280

astronauts into space

1225

00:42:44,550 --> 00:42:41,680

that the payoff there the payback there

1226
00:42:46,470 --> 00:42:44,560
uh will be immeasurable i believe

1227
00:42:47,990 --> 00:42:46,480
next chart please

1228
00:42:49,349 --> 00:42:48,000
in aviation

1229
00:42:52,309 --> 00:42:49,359
this is kind of a messy chart but

1230
00:42:53,829 --> 00:42:52,319
aviation really is the analog

1231
00:42:55,190 --> 00:42:53,839
the u.s

1232
00:42:58,069 --> 00:42:55,200
industry

1233
00:42:59,829 --> 00:42:58,079
had the lead in aviation we founded it

1234
00:43:01,349 --> 00:42:59,839
the wright brothers in 1903 were the

1235
00:43:03,670 --> 00:43:01,359
first to fly

1236
00:43:06,790 --> 00:43:03,680
fifteen years later we were well behind

1237
00:43:07,990 --> 00:43:06,800
the europeans french germans inspec in

1238
00:43:10,390 --> 00:43:08,000

aviation

1239

00:43:12,870 --> 00:43:10,400
and it took government enabling

1240

00:43:14,470 --> 00:43:12,880
that activity to come in to do the

1241

00:43:17,270 --> 00:43:14,480
things that government does best invest

1242

00:43:18,710 --> 00:43:17,280
in r d become a customer and develop and

1243

00:43:20,790 --> 00:43:18,720
operate things that are specific for

1244

00:43:22,870 --> 00:43:20,800
needs for the government

1245

00:43:23,910 --> 00:43:22,880
for aviation military aviation for

1246

00:43:28,150 --> 00:43:23,920
example

1247

00:43:30,069 --> 00:43:28,160
necessarily true for space flight

1248

00:43:31,750 --> 00:43:30,079
there's nothing unique about just

1249

00:43:33,430 --> 00:43:31,760
getting to space that should be a

1250

00:43:35,510 --> 00:43:33,440
government-only function forever and

1251
00:43:37,109 --> 00:43:35,520
ever it's time to transition that to the

1252
00:43:38,309 --> 00:43:37,119
private sector

1253
00:43:39,430 --> 00:43:38,319
if you look

1254
00:43:42,150 --> 00:43:39,440
at what

1255
00:43:44,150 --> 00:43:42,160
the the naca um

1256
00:43:45,589 --> 00:43:44,160
you know uh government involvement in

1257
00:43:47,510 --> 00:43:45,599
aviation did

1258
00:43:48,790 --> 00:43:47,520
uh for aviation it turned it into a

1259
00:43:52,470 --> 00:43:48,800
golden era

1260
00:43:53,829 --> 00:43:52,480
a golden age of of increased uh rapid

1261
00:43:55,990 --> 00:43:53,839
development of new systems new

1262
00:43:58,470 --> 00:43:56,000
prototypes people starting to fly

1263
00:44:00,150 --> 00:43:58,480

and for different purposes first in

1264

00:44:01,990 --> 00:44:00,160

terms of tourists we had first writ a

1265

00:44:04,069 --> 00:44:02,000

lot of rich people flying

1266

00:44:05,589 --> 00:44:04,079

uh kicking off the market for all of us

1267

00:44:07,670 --> 00:44:05,599

and today it's ingrained in the global

1268

00:44:09,190 --> 00:44:07,680

economy in a way that

1269

00:44:11,349 --> 00:44:09,200

people could not have imagined a hundred

1270

00:44:13,829 --> 00:44:11,359

years ago we need to do that for space

1271

00:44:15,430 --> 00:44:13,839

next chart please

1272

00:44:17,349 --> 00:44:15,440

and so here's

1273

00:44:19,670 --> 00:44:17,359

where we are with space

1274

00:44:21,750 --> 00:44:19,680

up until today we've never flown more

1275

00:44:23,510 --> 00:44:21,760

than about 50 people a year

1276

00:44:25,510 --> 00:44:23,520

in the us

1277

00:44:28,309 --> 00:44:25,520

we need to change that

1278

00:44:29,109 --> 00:44:28,319

i think with in the post shuttle era

1279

00:44:31,190 --> 00:44:29,119

with

1280

00:44:33,030 --> 00:44:31,200

private human space flight capabilities

1281

00:44:35,030 --> 00:44:33,040

enabled by nasa

1282

00:44:36,790 --> 00:44:35,040

we will end up with thousands

1283

00:44:39,109 --> 00:44:36,800

and tens of thousands of people flying

1284

00:44:41,430 --> 00:44:39,119

into space over the next 50 years we've

1285

00:44:42,950 --> 00:44:41,440

had 50 years of human space flight and

1286

00:44:45,670 --> 00:44:42,960

never have we put more than 50 people in

1287

00:44:47,829 --> 00:44:45,680

space in one year or about 50 people and

1288

00:44:49,990 --> 00:44:47,839

so while nasa's activity will greatly

1289

00:44:53,430 --> 00:44:50,000

increase i think that's only because

1290

00:44:54,550 --> 00:44:53,440

private activity will increase even more

1291

00:44:57,430 --> 00:44:54,560

and finally i just want to leave you

1292

00:44:58,470 --> 00:44:57,440

with the next chart which just shows a

1293

00:45:01,109 --> 00:44:58,480

range

1294

00:45:02,870 --> 00:45:01,119

uh oh sorry actually

1295

00:45:05,109 --> 00:45:02,880

first let me before i conclude let me

1296

00:45:06,710 --> 00:45:05,119

talk about the direct jobs that will be

1297

00:45:09,349 --> 00:45:06,720

created by the commercial crew program

1298

00:45:10,950 --> 00:45:09,359

that's proposed by the president

1299

00:45:12,630 --> 00:45:10,960

we recently commissioned a study by an

1300

00:45:14,309 --> 00:45:12,640

independent outside company called the

1301
00:45:16,550 --> 00:45:14,319
torai group

1302
00:45:18,309 --> 00:45:16,560
to look at the 6.1 billion dollars that

1303
00:45:20,550 --> 00:45:18,319
president obama's budget has in there

1304
00:45:21,990 --> 00:45:20,560
for commercial crew and cargo activities

1305
00:45:23,270 --> 00:45:22,000
we didn't include all sorts of other

1306
00:45:25,030 --> 00:45:23,280
monies that are in there we just said

1307
00:45:27,430 --> 00:45:25,040
what is this 6.1 billion dollars going

1308
00:45:31,109 --> 00:45:27,440
to go for and how many jobs will create

1309
00:45:33,510 --> 00:45:31,119
it's an average of 11 800 jobs

1310
00:45:35,030 --> 00:45:33,520
every year for the next five years

1311
00:45:36,790 --> 00:45:35,040
now that's not additive that's twelve

1312
00:45:38,390 --> 00:45:36,800
thousand roughly twelve thousand jobs

1313
00:45:39,990 --> 00:45:38,400

that are going to be there

1314

00:45:41,670 --> 00:45:40,000

for that five year period based on this

1315

00:45:43,430 --> 00:45:41,680

funding

1316

00:45:45,670 --> 00:45:43,440

a lot of those jobs about fifty about

1317

00:45:47,829 --> 00:45:45,680

twenty five percent of that money of 1.3

1318

00:45:49,990 --> 00:45:47,839

to 1.5 billion dollars of that is

1319

00:45:51,910 --> 00:45:50,000

directly related to launch activities

1320

00:45:53,670 --> 00:45:51,920

it's launch infrastructure it's building

1321

00:45:56,550 --> 00:45:53,680

launch vehicles it's the launch

1322

00:45:57,829 --> 00:45:56,560

operations a large chunk of that 1.5

1323

00:45:58,870 --> 00:45:57,839

billion is going to happen right here at

1324

00:46:02,309 --> 00:45:58,880

the cape

1325

00:46:04,470 --> 00:46:02,319

and so 25 of the money related to launch

1326

00:46:05,829 --> 00:46:04,480

you know a huge chunk of those jobs will

1327

00:46:07,430 --> 00:46:05,839

also be right here at the cape and of

1328

00:46:08,390 --> 00:46:07,440

course florida can get a lot more of

1329

00:46:10,790 --> 00:46:08,400

that

1330

00:46:12,230 --> 00:46:10,800

activity uh if it branches out into

1331

00:46:14,470 --> 00:46:12,240

other parts of manufacturing and

1332

00:46:15,910 --> 00:46:14,480

processing and assembly of vehicles

1333

00:46:18,309 --> 00:46:15,920

so these are very important numbers i

1334

00:46:20,390 --> 00:46:18,319

think they're very robust and i think

1335

00:46:23,109 --> 00:46:20,400

uh the rigor the analytical rigor behind

1336

00:46:25,030 --> 00:46:23,119

them uh is tremendous uh and they really

1337

00:46:26,309 --> 00:46:25,040

are well sourced

1338

00:46:27,270 --> 00:46:26,319

next

1339

00:46:28,870 --> 00:46:27,280

chart

1340

00:46:31,190 --> 00:46:28,880

so i just want to leave you with this

1341

00:46:32,870 --> 00:46:31,200

that there's a lot of

1342

00:46:33,990 --> 00:46:32,880

that can happen because of commercial

1343

00:46:36,390 --> 00:46:34,000

crew

1344

00:46:37,430 --> 00:46:36,400

um it's a good program it changes

1345

00:46:40,309 --> 00:46:37,440

everything

1346

00:46:43,270 --> 00:46:40,319

uh over time uh and the time is now so

1347

00:46:44,630 --> 00:46:43,280

thank you very much thank you very much

1348

00:46:45,589 --> 00:46:44,640

all right

1349

00:46:46,790 --> 00:46:45,599

everyone

1350

00:46:48,390 --> 00:46:46,800

i certainly want to encourage any

1351
00:46:49,670 --> 00:46:48,400
questions or comments from the crowd so

1352
00:46:50,630 --> 00:46:49,680
uh if you have something to start

1353
00:46:52,710 --> 00:46:50,640
raising your hand we're going to get a

1354
00:46:53,670 --> 00:46:52,720
microphone to you um oh you have one

1355
00:46:55,430 --> 00:46:53,680
right away

1356
00:46:57,829 --> 00:46:55,440
yeah okay no i'm sorry i've

1357
00:46:59,430 --> 00:46:57,839
misunderstood so uh mike full let's uh

1358
00:47:01,670 --> 00:46:59,440
talk a little bit about uh the vision

1359
00:47:03,349 --> 00:47:01,680
here uh first of all going back to what

1360
00:47:05,109 --> 00:47:03,359
the president said today and and and

1361
00:47:07,990 --> 00:47:05,119
we've this had leaked out a couple of

1362
00:47:10,950 --> 00:47:08,000
days ago but this notion of building uh

1363
00:47:13,270 --> 00:47:10,960

a crew life boat orion light is the term

1364

00:47:17,030 --> 00:47:13,280

um what do you think of that idea and

1365

00:47:21,109 --> 00:47:19,190

uh

1366

00:47:22,390 --> 00:47:21,119

it was it was a very relevant and in

1367

00:47:24,470 --> 00:47:22,400

fact um

1368

00:47:25,990 --> 00:47:24,480

important announcement recognition i

1369

00:47:26,870 --> 00:47:26,000

think is the way to put it

1370

00:47:27,990 --> 00:47:26,880

the way

1371

00:47:29,750 --> 00:47:28,000

the action office when they were

1372

00:47:31,750 --> 00:47:29,760

assessing

1373

00:47:33,109 --> 00:47:31,760

the transition to commercial crew and

1374

00:47:36,870 --> 00:47:33,119

what it meant for

1375

00:47:38,950 --> 00:47:36,880

the nasa government astronaut employee

1376

00:47:39,990 --> 00:47:38,960

we had a long discussion internally

1377

00:47:41,990 --> 00:47:40,000

about

1378

00:47:43,510 --> 00:47:42,000

what you know uh

1379

00:47:45,030 --> 00:47:43,520

should there be a government vehicle at

1380

00:47:46,790 --> 00:47:45,040

all times to take us to uh the

1381

00:47:49,109 --> 00:47:46,800

international space station

1382

00:47:52,549 --> 00:47:49,119

um i personally believe that uh having a

1383

00:47:56,549 --> 00:47:54,150

and funded in the normal traditional

1384

00:47:58,630 --> 00:47:56,559

contractual way would be a competition

1385

00:48:00,790 --> 00:47:58,640

to the commercial enterprise that you're

1386

00:48:02,630 --> 00:48:00,800

trying to foster so i i didn't see that

1387

00:48:04,309 --> 00:48:02,640

as being particularly

1388

00:48:07,270 --> 00:48:04,319

positive but is that is that fair

1389

00:48:09,109 --> 00:48:07,280

competition you think i i think what the

1390

00:48:11,510 --> 00:48:09,119

what they've recently announced is that

1391

00:48:13,349 --> 00:48:11,520

the uh orion spacecraft will actually

1392

00:48:15,589 --> 00:48:13,359

just be a return vehicle so it won't be

1393

00:48:17,829 --> 00:48:15,599

taking people up uh it'll be there as a

1394

00:48:19,510 --> 00:48:17,839

lifeboat for several years at a time and

1395

00:48:21,829 --> 00:48:19,520

doesn't present competition to the

1396

00:48:23,270 --> 00:48:21,839

commercial side and in fact it's

1397

00:48:24,790 --> 00:48:23,280

actually a good thing for the commercial

1398

00:48:27,589 --> 00:48:24,800

side because it gets

1399

00:48:29,510 --> 00:48:27,599

those uh entities uh out of the

1400

00:48:30,950 --> 00:48:29,520

day-to-day continual operation of the

1401

00:48:34,630 --> 00:48:30,960

station they're not an integral function

1402

00:48:37,349 --> 00:48:34,640

of the station 24 7 365 days a year for

1403

00:48:39,030 --> 00:48:37,359

years on end it's really all about

1404

00:48:40,710 --> 00:48:39,040

uh they will be operational only in

1405

00:48:42,549 --> 00:48:40,720

those you know one week or two week long

1406

00:48:44,470 --> 00:48:42,559

trips that they make up so i think it's

1407

00:48:46,710 --> 00:48:44,480

a good thing both for commercial crew

1408

00:48:48,309 --> 00:48:46,720

program and the way it's being designed

1409

00:48:50,069 --> 00:48:48,319

as well as a necessary component of the

1410

00:48:53,670 --> 00:48:50,079

spacecraft and finish your point so so

1411

00:48:58,390 --> 00:48:57,109

i was pleased uh that the investment in

1412

00:49:01,750 --> 00:48:58,400

the

1413

00:49:04,309 --> 00:49:01,760

orion vehicle as a deep space vehicle

1414

00:49:06,470 --> 00:49:04,319
was not going to be thrown away

1415

00:49:08,549 --> 00:49:06,480
and i'm thinking of its solar arrays i'm

1416

00:49:10,230 --> 00:49:08,559
thinking of its thermal systems i'm

1417

00:49:11,430 --> 00:49:10,240
thinking of its ability to leave low

1418

00:49:13,270 --> 00:49:11,440
earth orbit

1419

00:49:15,349 --> 00:49:13,280
and if some of that is left

1420

00:49:17,349 --> 00:49:15,359
in the in the project

1421

00:49:19,190 --> 00:49:17,359
and we come to

1422

00:49:22,309 --> 00:49:19,200
the the point that the ashland office

1423

00:49:24,390 --> 00:49:22,319
came to which was we do need a seat to

1424

00:49:26,710 --> 00:49:24,400
come home from the international space

1425

00:49:28,790 --> 00:49:26,720
station for all visitors

1426

00:49:31,349 --> 00:49:28,800

and permanent crew

1427

00:49:33,109 --> 00:49:31,359

because we can

1428

00:49:34,870 --> 00:49:33,119

since we're in low earth orbit

1429

00:49:37,190 --> 00:49:34,880

if you think of yourself as a ship

1430

00:49:39,670 --> 00:49:37,200

that's sinking the lifeboats don't take

1431

00:49:41,589 --> 00:49:39,680

you to america or to europe they hang

1432

00:49:43,750 --> 00:49:41,599

around until you get picked up that's

1433

00:49:45,030 --> 00:49:43,760

what the lifeboats do but in this case

1434

00:49:46,790 --> 00:49:45,040

we're being told there's going to be a

1435

00:49:48,309 --> 00:49:46,800

lifeboat that can take us all the way

1436

00:49:49,990 --> 00:49:48,319

home

1437

00:49:51,510 --> 00:49:50,000

and that's because we think we can

1438

00:49:52,790 --> 00:49:51,520

morally i think there's a reason to

1439

00:49:54,470 --> 00:49:52,800

justify

1440

00:49:55,829 --> 00:49:54,480

given that you have that lifeboat

1441

00:49:58,549 --> 00:49:55,839

capability now

1442

00:49:59,910 --> 00:49:58,559

part of the president's plan

1443

00:50:01,829 --> 00:49:59,920

it does mean that the commercial

1444

00:50:04,069 --> 00:50:01,839

entities

1445

00:50:06,710 --> 00:50:04,079

and i would mention uh

1446

00:50:08,470 --> 00:50:06,720

boeing for example uh

1447

00:50:09,829 --> 00:50:08,480

spacex

1448

00:50:11,910 --> 00:50:09,839

those are two other entities that are

1449

00:50:13,270 --> 00:50:11,920

bidding on commercial or not bidding yet

1450

00:50:15,030 --> 00:50:13,280

but they're interested in commercial

1451

00:50:17,510 --> 00:50:15,040

services they could also offer to

1452

00:50:19,829 --> 00:50:17,520

provide the lifeboat function

1453

00:50:21,829 --> 00:50:19,839

and i just have to hope that that is not

1454

00:50:24,069 --> 00:50:21,839

in competition with or the government is

1455

00:50:26,950 --> 00:50:24,079

not competing with those offers so that

1456

00:50:29,829 --> 00:50:26,960

has to work itself out the deep space

1457

00:50:33,030 --> 00:50:31,829

orion vehicle is very very interesting

1458

00:50:34,870 --> 00:50:33,040

to me

1459

00:50:36,710 --> 00:50:34,880

and uh indeed of course i believe the

1460

00:50:38,710 --> 00:50:36,720

lockheed company will

1461

00:50:41,109 --> 00:50:38,720

lockheed martin will look at it as their

1462

00:50:43,030 --> 00:50:41,119

opportunity to take people to space also

1463

00:50:45,589 --> 00:50:43,040

to space not that the government will

1464

00:50:47,270 --> 00:50:45,599

pay for that as a contract but that they

1465

00:50:48,470 --> 00:50:47,280

will probably take that opportunity to

1466

00:50:50,470 --> 00:50:48,480

do that

1467

00:50:53,270 --> 00:50:50,480

but the uh the question then is if you

1468

00:50:55,670 --> 00:50:53,280

have a vehicle there that's purely for

1469

00:50:58,710 --> 00:50:55,680

lifeboat services and is rated for human

1470

00:51:01,670 --> 00:50:58,720

beings coming down

1471

00:51:04,790 --> 00:51:01,680

but not up because the the launchers are

1472

00:51:06,630 --> 00:51:04,800

not yet rated to carry them up

1473

00:51:08,390 --> 00:51:06,640

or there may not be an escape system

1474

00:51:10,309 --> 00:51:08,400

then when that vehicle's been there for

1475

00:51:13,510 --> 00:51:10,319

say six months or two years whatever the

1476

00:51:17,109 --> 00:51:15,829

we could get to that tourist model

1477

00:51:19,910 --> 00:51:17,119

that the russians have been thinking

1478

00:51:23,190 --> 00:51:19,920

about for more than five years

1479

00:51:24,790 --> 00:51:23,200

where by a descending

1480

00:51:26,950 --> 00:51:24,800

lifeboat

1481

00:51:29,270 --> 00:51:26,960

doesn't go straight to earth but it is

1482

00:51:30,870 --> 00:51:29,280

joined up with

1483

00:51:34,390 --> 00:51:30,880

a launched

1484

00:51:37,270 --> 00:51:34,400

earth departure stage on a an expendable

1485

00:51:38,549 --> 00:51:37,280

that docks with the descending

1486

00:51:41,190 --> 00:51:38,559

lifeboat

1487

00:51:45,589 --> 00:51:41,200

and is then boosted in a round-the-moon

1488

00:51:46,309 --> 00:51:45,599

flight for six days before doing

1489

00:52:02,309 --> 00:51:46,319

a

1490

00:52:04,950 --> 00:52:02,319

the 70s

1491

00:52:08,390 --> 00:52:04,960

whereby using this using the thermal

1492

00:52:09,349 --> 00:52:08,400

protection system of the soyuz if the ce

1493

00:52:10,390 --> 00:52:09,359

if the

1494

00:52:12,390 --> 00:52:10,400

orion

1495

00:52:13,750 --> 00:52:12,400

return vehicle had the

1496

00:52:15,829 --> 00:52:13,760

the thermal

1497

00:52:18,790 --> 00:52:15,839

protection system on it that it was

1498

00:52:20,710 --> 00:52:18,800

being designed to have to return from

1499

00:52:22,390 --> 00:52:20,720

the moon it could actually do a

1500

00:52:24,790 --> 00:52:22,400

round-the-moon flight

1501
00:52:27,750 --> 00:52:24,800
on the way back from serving its purpose

1502
00:52:31,109 --> 00:52:27,760
as a lifeboat at the station

1503
00:52:32,790 --> 00:52:31,119
what i like about that possibility is

1504
00:52:35,349 --> 00:52:32,800
the opportunity to

1505
00:52:36,950 --> 00:52:35,359
start leaving low earth orbit and going

1506
00:52:41,030 --> 00:52:36,960
after the propellant

1507
00:52:41,910 --> 00:52:41,040
i farm ideas of using I1 as a transition

1508
00:52:44,829 --> 00:52:41,920
point

1509
00:52:46,710 --> 00:52:44,839
um out of low earth orbit beyond the

1510
00:52:49,270 --> 00:52:46,720
moon and

1511
00:52:51,190 --> 00:52:49,280
it also allows us to offer a parallel

1512
00:52:53,270 --> 00:52:51,200
path to the russians to do something

1513
00:52:55,109 --> 00:52:53,280

similar

1514

00:52:56,870 --> 00:52:55,119

so that in the end

1515

00:52:59,510 --> 00:52:56,880

having this capability to use the space

1516

00:53:00,790 --> 00:52:59,520

station as a transportation node out of

1517

00:53:04,630 --> 00:53:00,800

low earth orbit

1518

00:53:06,950 --> 00:53:04,640

to l1 and beyond um

1519

00:53:08,470 --> 00:53:06,960

would have some significant value

1520

00:53:10,069 --> 00:53:08,480

because if we were building a redundant

1521

00:53:11,510 --> 00:53:10,079

path if we could get our partners to do

1522

00:53:13,670 --> 00:53:11,520

the same thing

1523

00:53:17,030 --> 00:53:13,680

tom let's talk a little bit about um

1524

00:53:18,870 --> 00:53:17,040

conducting research on on the station uh

1525

00:53:20,870 --> 00:53:18,880

you've had great dealings with nasa it

1526

00:53:22,630 --> 00:53:20,880

sounds like you you you don't need

1527

00:53:24,150 --> 00:53:22,640

anything fixed in order to do business

1528

00:53:26,790 --> 00:53:24,160

but some have suggested maybe you have

1529

00:53:28,390 --> 00:53:26,800

to set up some sort of non-profit entity

1530

00:53:29,589 --> 00:53:28,400

i know that that's been talked about to

1531

00:53:31,109 --> 00:53:29,599

sort of

1532

00:53:35,190 --> 00:53:31,119

channel

1533

00:53:36,549 --> 00:53:35,200

researchers and nasa and the station is

1534

00:53:38,470 --> 00:53:36,559

that necessary is that just an extra

1535

00:53:40,870 --> 00:53:38,480

layer can you do business just fine as

1536

00:53:46,710 --> 00:53:43,430

i think that when they were flying most

1537

00:53:49,190 --> 00:53:46,720

of the science back in the um

1538

00:53:50,950 --> 00:53:49,200

early 2000s and

1539

00:53:52,790 --> 00:53:50,960

late 1990s

1540

00:53:55,030 --> 00:53:52,800

they had a pro they had a program where

1541

00:53:56,150 --> 00:53:55,040

nasa took money from their budget and

1542

00:53:57,670 --> 00:53:56,160

they put it through the centers of

1543

00:53:58,549 --> 00:53:57,680

excellence the centers of excellence

1544

00:54:00,710 --> 00:53:58,559

then

1545

00:54:03,109 --> 00:54:00,720

they submitted what they thought their

1546

00:54:05,589 --> 00:54:03,119

research and best research to be

1547

00:54:07,430 --> 00:54:05,599

proposed and accepted was they had a

1548

00:54:09,510 --> 00:54:07,440

review committee the review committee

1549

00:54:11,510 --> 00:54:09,520

went over that the pis were selected and

1550

00:54:13,109 --> 00:54:11,520

the experiments were selected and then

1551
00:54:14,470 --> 00:54:13,119
they were put into a manifest that

1552
00:54:16,950 --> 00:54:14,480
slipped a lot because they were

1553
00:54:20,309 --> 00:54:16,960
constructing the station admittedly and

1554
00:54:22,790 --> 00:54:20,319
but they did fly eventually

1555
00:54:24,069 --> 00:54:22,800
how do i feel about that program i guess

1556
00:54:26,470 --> 00:54:24,079
is really where you have to you have to

1557
00:54:27,750 --> 00:54:26,480
begin the answer to what you're you're

1558
00:54:29,270 --> 00:54:27,760
just asking

1559
00:54:30,230 --> 00:54:29,280
um

1560
00:54:32,069 --> 00:54:30,240
i've looked through all those

1561
00:54:33,829 --> 00:54:32,079
experiments and i saw

1562
00:54:35,910 --> 00:54:33,839
kind of between the lines when you start

1563
00:54:38,309 --> 00:54:35,920

reading hundreds of these

1564

00:54:40,390 --> 00:54:38,319

you you start reading into each one of

1565

00:54:42,390 --> 00:54:40,400

these reports that's mandated by the

1566

00:54:44,150 --> 00:54:42,400

nasa funding that the pis have to

1567

00:54:46,230 --> 00:54:44,160

provide and so the reports kind of fit

1568

00:54:48,230 --> 00:54:46,240

into this one format

1569

00:54:49,750 --> 00:54:48,240

and they're kind of it's sort of a

1570

00:54:51,430 --> 00:54:49,760

cinderella's

1571

00:54:52,950 --> 00:54:51,440

shoe kind of thing you know sometimes it

1572

00:54:54,069 --> 00:54:52,960

doesn't fit but they put it in there

1573

00:54:55,430 --> 00:54:54,079

anyway

1574

00:54:57,030 --> 00:54:55,440

and it

1575

00:54:58,230 --> 00:54:57,040

you know but you get to where you get

1576

00:55:00,309 --> 00:54:58,240

really good at kind of reading in

1577

00:55:02,789 --> 00:55:00,319

between the lines and then we did a lot

1578

00:55:05,349 --> 00:55:02,799

of communications with the pis that were

1579

00:55:07,430 --> 00:55:05,359

then conducting the the experiments back

1580

00:55:09,990 --> 00:55:07,440

then if we if it caught our interest and

1581

00:55:12,950 --> 00:55:10,000

we did a lot of that interplay as well

1582

00:55:14,069 --> 00:55:12,960

um i think that it it worked good at the

1583

00:55:16,069 --> 00:55:14,079

time

1584

00:55:17,589 --> 00:55:16,079

i think that it probably could be

1585

00:55:21,910 --> 00:55:17,599

improved upon

1586

00:55:25,270 --> 00:55:21,920

i don't like seeing nasa money that is

1587

00:55:29,190 --> 00:55:25,280

being diverted through really a manned

1588

00:55:31,190 --> 00:55:29,200

space flight space hardware

1589

00:55:33,510 --> 00:55:31,200

entity called nasa

1590

00:55:35,510 --> 00:55:33,520

and you're trying to go and put science

1591

00:55:38,549 --> 00:55:35,520

up there i really think that's the role

1592

00:55:40,950 --> 00:55:38,559

of the nih in the nsf frankly i'd like

1593

00:55:42,950 --> 00:55:40,960

to ask you did mention tom uh the the

1594

00:55:44,870 --> 00:55:42,960

other labs doing a lot of the stuff i

1595

00:55:46,390 --> 00:55:44,880

believe that's where a lot of the other

1596

00:55:53,990 --> 00:55:46,400

traffic should come from is from the

1597

00:55:58,150 --> 00:55:56,549

as i tell my kids it's just money

1598

00:55:59,589 --> 00:55:58,160

you know and let me add to that though

1599

00:56:01,990 --> 00:55:59,599

that you know when you get into a

1600

00:56:04,789 --> 00:56:02,000

commercial module our model for

1601
00:56:06,630 --> 00:56:04,799
providing services crew as well as cargo

1602
00:56:08,950 --> 00:56:06,640
they're incentivized to go out to those

1603
00:56:11,430 --> 00:56:08,960
other areas as other agencies and find

1604
00:56:13,349 --> 00:56:11,440
customers you know you are incentivized

1605
00:56:15,270 --> 00:56:13,359
to go out and find customers if we leave

1606
00:56:16,549 --> 00:56:15,280
it up to nasa you know they're not

1607
00:56:17,910 --> 00:56:16,559
incentivizing that's not their business

1608
00:56:19,910 --> 00:56:17,920
it's not about business it's not their

1609
00:56:21,589 --> 00:56:19,920
business they did the best they could i

1610
00:56:24,230 --> 00:56:21,599
mean every time anybody ever asked me

1611
00:56:26,789 --> 00:56:24,240
what they think what i think of nasa i

1612
00:56:27,829 --> 00:56:26,799
you know darner get teary-eyed yeah i

1613
00:56:30,710 --> 00:56:27,839

love them

1614

00:56:32,950 --> 00:56:30,720

what they do they do beautifully and you

1615

00:56:35,030 --> 00:56:32,960

know yeah well it may cost more they

1616

00:56:37,670 --> 00:56:35,040

made this or whatever i don't care the

1617

00:56:39,829 --> 00:56:37,680

results are we have a a national

1618

00:56:43,270 --> 00:56:39,839

laboratory that's floating around right

1619

00:56:44,710 --> 00:56:43,280

now at 17 500 miles an hour at 220 miles

1620

00:56:46,789 --> 00:56:44,720

up with six people in it and they're

1621

00:56:50,950 --> 00:56:46,799

living very comfortably as you just saw

1622

00:56:52,710 --> 00:56:50,960

i mean that's i don't care what kind of

1623

00:56:55,109 --> 00:56:52,720

you know criticism you can put on

1624

00:56:57,589 --> 00:56:55,119

something the results are always if

1625

00:56:59,990 --> 00:56:57,599

they're put in nasa's

1626
00:57:02,470 --> 00:57:00,000
their their whole mentality in the whole

1627
00:57:05,829 --> 00:57:02,480
kind of atmosphere that's at nasa is one

1628
00:57:07,990 --> 00:57:05,839
for success and they get the job done

1629
00:57:10,230 --> 00:57:08,000
but this isn't their job this is what

1630
00:57:12,069 --> 00:57:10,240
the nih is supposed to do with their 20

1631
00:57:14,549 --> 00:57:12,079
billion dollars that they get each year

1632
00:57:16,710 --> 00:57:14,559
and the nsf and there's plenty of other

1633
00:57:18,710 --> 00:57:16,720
things too the ag department has

1634
00:57:20,069 --> 00:57:18,720
research dollars as well and there's

1635
00:57:22,230 --> 00:57:20,079
lots of things that says that if you

1636
00:57:24,069 --> 00:57:22,240
grow microbes up there in my little

1637
00:57:26,710 --> 00:57:24,079
microbes or you can also grow things

1638
00:57:28,870 --> 00:57:26,720

like algae and you can find super algae

1639

00:57:30,870 --> 00:57:28,880

and come back and find the genetics of

1640

00:57:32,710 --> 00:57:30,880

how to replicate that and you can create

1641

00:57:34,150 --> 00:57:32,720

an algae that could go into a biofuel

1642

00:57:35,750 --> 00:57:34,160

that could end up maybe changing the

1643

00:57:37,190 --> 00:57:35,760

world but you don't know that yet

1644

00:57:38,470 --> 00:57:37,200

because the basic science hasn't been

1645

00:57:40,069 --> 00:57:38,480

done there's been theory and there's

1646

00:57:41,910 --> 00:57:40,079

been a little bit of a few attempts to

1647

00:57:43,750 --> 00:57:41,920

do that but there's not anything that's

1648

00:57:45,990 --> 00:57:43,760

been conclusive of it so the answer to

1649

00:57:48,470 --> 00:57:46,000

you is is a non-profit we already have

1650

00:57:51,109 --> 00:57:48,480

one it's called the nih it's called the

1651
00:57:52,950 --> 00:57:51,119
nsf do we want to create a new one well

1652
00:57:54,870 --> 00:57:52,960
maybe if you want to go get you know the

1653
00:57:56,470 --> 00:57:54,880
the you know bill and melinda gates

1654
00:57:57,750 --> 00:57:56,480
foundation to go put money into

1655
00:58:01,190 --> 00:57:57,760
something

1656
00:58:02,230 --> 00:58:01,200
maybe or outside contributors i guess so

1657
00:58:03,750 --> 00:58:02,240
um

1658
00:58:05,910 --> 00:58:03,760
if it's private it's from the private

1659
00:58:06,789 --> 00:58:05,920
sector no one's ever tried to do that

1660
00:58:08,230 --> 00:58:06,799
but it's important to have that

1661
00:58:09,990 --> 00:58:08,240
structure you think whatever it is

1662
00:58:11,990 --> 00:58:10,000
whether it's the nih or for basic

1663
00:58:13,990 --> 00:58:12,000

science you bet i don't think that you

1664

00:58:15,910 --> 00:58:14,000

can go get somebody who can't get money

1665

00:58:17,510 --> 00:58:15,920

for basic science right it's not it's

1666

00:58:19,030 --> 00:58:17,520

too new yeah and you know what we're

1667

00:58:21,750 --> 00:58:19,040

used to it there's another thing there

1668

00:58:23,030 --> 00:58:21,760

too is we're used to it being you know

1669

00:58:24,950 --> 00:58:23,040

that's that the government pays for

1670

00:58:26,710 --> 00:58:24,960

basic science yeah i just got the rap

1671

00:58:28,069 --> 00:58:26,720

cue does anybody have a quick we've got

1672

00:58:29,750 --> 00:58:28,079

an awesome audience i mean they're more

1673

00:58:31,349 --> 00:58:29,760

quiet now i know well i want to hear

1674

00:58:32,230 --> 00:58:31,359

what they think just a little bit yeah

1675

00:58:33,750 --> 00:58:32,240

go ahead

1676

00:58:35,430 --> 00:58:33,760

well okay a quick question one of you

1677

00:58:38,390 --> 00:58:35,440

were talking about increasing access and

1678

00:58:40,950 --> 00:58:38,400

i saw one of the slides why don't we

1679

00:58:45,270 --> 00:58:40,960

open to more international partners you

1680

00:58:49,829 --> 00:58:47,190

the big yeah the chinese i mean you know

1681

00:58:51,990 --> 00:58:49,839

obviously they got me unrated things and

1682

00:58:56,950 --> 00:58:52,000

why don't we get them involved

1683

00:59:01,510 --> 00:58:59,430

somebody wants that question i i don't i

1684

00:59:02,789 --> 00:59:01,520

don't think that that's necessarily

1685

00:59:04,870 --> 00:59:02,799

a bad thing

1686

00:59:06,470 --> 00:59:04,880

that but that's a foreign policy issue

1687

00:59:08,789 --> 00:59:06,480

and that's not really about whether we

1688

00:59:10,390 --> 00:59:08,799

have access to the station or not that

1689

00:59:12,230 --> 00:59:10,400

that were done in access that mike was

1690

00:59:14,789 --> 00:59:12,240

talking about we need two u.s

1691

00:59:16,549 --> 00:59:14,799

capabilities to get there uh

1692

00:59:18,950 --> 00:59:16,559

regardless of our international partners

1693

00:59:21,109 --> 00:59:18,960

that's what u.s leadership in u.s you

1694

00:59:22,870 --> 00:59:21,119

know independence in space really means

1695

00:59:24,470 --> 00:59:22,880

so we can invite partners in or we

1696

00:59:26,710 --> 00:59:24,480

cannot invite them in based on foreign

1697

00:59:29,109 --> 00:59:26,720

policy but having that that access

1698

00:59:31,990 --> 00:59:29,119

ourselves is is good and and having this

1699

00:59:34,309 --> 00:59:32,000

uh this uh crew return module that that

1700

00:59:36,549 --> 00:59:34,319

you know uh that we talked about was was

1701

00:59:39,670 --> 00:59:36,559

something that was planned originally on

1702

00:59:43,589 --> 00:59:39,680

space station freedom and iss uh and was

1703

00:59:45,510 --> 00:59:43,599

was canceled about 10 years ago

1704

00:59:47,190 --> 00:59:45,520

but it's a capability that also provides

1705

00:59:49,270 --> 00:59:47,200

us that independence rather than relying

1706

00:59:51,510 --> 00:59:49,280

on our foreign partners for it so so in

1707

00:59:53,990 --> 00:59:51,520

developing that that the the the

1708

00:59:55,990 --> 00:59:54,000

multiple commercial capabilities you

1709

00:59:59,109 --> 00:59:56,000

know nasa's put forward a 6.1 billion

1710

01:00:00,870 --> 00:59:59,119

dollar budget that's a lot of money but

1711

01:00:02,230 --> 01:00:00,880

you know in in terms of doing this it's

1712

01:00:04,069 --> 01:00:02,240

not a lot of money and it's barely

1713

01:00:05,670 --> 01:00:04,079

sufficient we need to to make sure that

1714

01:00:07,430 --> 01:00:05,680

you know we don't

1715

01:00:09,109 --> 01:00:07,440

piece part these things out so that we

1716

01:00:10,390 --> 01:00:09,119

whittle those those funds down to where

1717

01:00:12,630 --> 01:00:10,400

we can't actually develop the

1718

01:00:14,390 --> 01:00:12,640

capabilities so as far as you know the

1719

01:00:16,950 --> 01:00:14,400

crew rescue module or

1720

01:00:19,589 --> 01:00:16,960

other science activities or other uh

1721

01:00:21,190 --> 01:00:19,599

flagship missions you know let's let's

1722

01:00:23,670 --> 01:00:21,200

keep those budgets away and make sure

1723

01:00:25,910 --> 01:00:23,680

that we have this program solid on solid

1724

01:00:28,710 --> 01:00:25,920

footing to to give us that independent

1725

01:00:29,670 --> 01:00:28,720

access in space we're still over time

1726

01:00:31,030 --> 01:00:29,680

but we're going to go just a little bit

1727

01:00:32,390 --> 01:00:31,040

longer just because we got to get here

1728

01:00:33,829 --> 01:00:32,400

for just a little bit yeah okay

1729

01:00:35,670 --> 01:00:33,839

districts let's run the interwebs all

1730

01:00:37,829 --> 01:00:35,680

right go ahead question uh i'm a

1731

01:00:39,510 --> 01:00:37,839

professor up at amy riddle and a lot of

1732

01:00:41,349 --> 01:00:39,520

my students already state your name so

1733

01:00:43,349 --> 01:00:41,359

uh jason kring and i'm a professor at

1734

01:00:45,430 --> 01:00:43,359

emirate aeronautical university

1735

01:00:46,950 --> 01:00:45,440

uh we teach courses and a lot of the

1736

01:00:48,230 --> 01:00:46,960

students already enthusiastic about

1737

01:00:50,789 --> 01:00:48,240

space

1738

01:00:52,950 --> 01:00:50,799

but for the larger population you see

1739

01:00:55,510 --> 01:00:52,960

iss as being a great opportunity to

1740

01:00:56,710 --> 01:00:55,520

bring more the general population and

1741

01:00:58,710 --> 01:00:56,720

tom the stuff you're talking about with

1742

01:01:00,630 --> 01:00:58,720

the uh the research there that's

1743

01:01:02,710 --> 01:01:00,640

fascinating but i think a lot of times

1744

01:01:04,710 --> 01:01:02,720

scientists are not good and you're not

1745

01:01:06,549 --> 01:01:04,720

one of the i'm including in this group

1746

01:01:08,390 --> 01:01:06,559

that are not good about explaining

1747

01:01:09,670 --> 01:01:08,400

what's really going on in a way that

1748

01:01:11,270 --> 01:01:09,680

someone sitting at home can say well

1749

01:01:12,470 --> 01:01:11,280

damn that's exciting

1750

01:01:13,910 --> 01:01:12,480

so it

1751
01:01:15,829 --> 01:01:13,920
made its quick points about how we can

1752
01:01:17,750 --> 01:01:15,839
use iss as a way to get the general

1753
01:01:19,990 --> 01:01:17,760
population and particularly students to

1754
01:01:21,589 --> 01:01:20,000
say as you did there's people living up

1755
01:01:23,829 --> 01:01:21,599
in space right now but we don't really

1756
01:01:25,589 --> 01:01:23,839
think about it it's another space flight

1757
01:01:27,349 --> 01:01:25,599
mission another shuttle mission

1758
01:01:28,630 --> 01:01:27,359
the general public uh a lot of the

1759
01:01:30,870 --> 01:01:28,640
people i talked to it's just kind of

1760
01:01:32,069 --> 01:01:30,880
like well we're going on up there so

1761
01:01:33,349 --> 01:01:32,079
thoughts on that

1762
01:01:34,950 --> 01:01:33,359
i don't want to be the full answer on

1763
01:01:37,349 --> 01:01:34,960

this but i will tell you one thing is

1764

01:01:39,910 --> 01:01:37,359

it's an agency nasa is it's not a

1765

01:01:42,710 --> 01:01:39,920

department a department like like the

1766

01:01:44,390 --> 01:01:42,720

army can pay for uh cars to go around a

1767

01:01:47,430 --> 01:01:44,400

nascar track for four and a half hours

1768

01:01:49,829 --> 01:01:47,440

with their name on it nasa cannot so it

1769

01:01:52,150 --> 01:01:49,839

can't pay for someone to go as an

1770

01:01:54,309 --> 01:01:52,160

advertising agency to go out and exploit

1771

01:01:56,069 --> 01:01:54,319

this and they use their own engineers

1772

01:01:58,230 --> 01:01:56,079

and their own scientists to do the best

1773

01:02:00,150 --> 01:01:58,240

they can and they do they're just not

1774

01:02:02,230 --> 01:02:00,160

trained to do that and they don't have

1775

01:02:04,670 --> 01:02:02,240

the budget and nor does congress give

1776

01:02:06,470 --> 01:02:04,680

them the ability to pay for

1777

01:02:08,150 --> 01:02:06,480

self-exploitation like they i believe

1778

01:02:10,390 --> 01:02:08,160

they should have they that's a that's a

1779

01:02:12,630 --> 01:02:10,400

cinch they ask that you know 10 or 20

1780

01:02:14,710 --> 01:02:12,640

million bucks a year

1781

01:02:16,309 --> 01:02:14,720

sure

1782

01:02:18,630 --> 01:02:16,319

they do the best they can they're not

1783

01:02:20,390 --> 01:02:18,640

trained to you get a guy like miles over

1784

01:02:22,950 --> 01:02:20,400

here and put him in front of that and

1785

01:02:24,150 --> 01:02:22,960

he'll go set me up you know i know

1786

01:02:25,349 --> 01:02:24,160

you'll get the hair on your back you

1787

01:02:27,109 --> 01:02:25,359

know

1788

01:02:29,190 --> 01:02:27,119

let me just add one thing when we have

1789

01:02:31,829 --> 01:02:29,200

private companies able to put people in

1790

01:02:33,190 --> 01:02:31,839

space they'll be hiring people for as

1791

01:02:34,549 --> 01:02:33,200

astronauts and pilots and they'll be

1792

01:02:36,549 --> 01:02:34,559

advertising and they'll be able to put

1793

01:02:37,510 --> 01:02:36,559

the coca-cola logo you know on what

1794

01:02:39,510 --> 01:02:37,520

they're doing and they'll be able to

1795

01:02:41,029 --> 01:02:39,520

make you know movies in space and all

1796

01:02:42,470 --> 01:02:41,039

those other things

1797

01:02:44,470 --> 01:02:42,480

that you're actually prohibited to have

1798

01:02:46,150 --> 01:02:44,480

nasa employees doing

1799

01:02:47,750 --> 01:02:46,160

on the space station so

1800

01:02:49,029 --> 01:02:47,760

having the private sector involved in a

1801

01:02:50,710 --> 01:02:49,039

different way than it has been in the

1802

01:02:52,549 --> 01:02:50,720

past opens up a whole bunch of

1803

01:02:54,150 --> 01:02:52,559

possibilities brings marketing with it

1804

01:02:55,190 --> 01:02:54,160

all right i'm really way over time but

1805

01:02:56,549 --> 01:02:55,200

i'll tell you what let's take one more

1806

01:02:58,069 --> 01:02:56,559

state your name quickly and then we're

1807

01:03:00,390 --> 01:02:58,079

going to before getting deep trouble

1808

01:03:01,829 --> 01:03:00,400

from interest

1809

01:03:04,230 --> 01:03:01,839

under the current configuration there's

1810

01:03:05,589 --> 01:03:04,240

only like two pmas on

1811

01:03:06,470 --> 01:03:05,599

station currently right now is that

1812

01:03:07,990 --> 01:03:06,480

correct

1813

01:03:08,950 --> 01:03:08,000

these are docking ports docking boards

1814

01:03:10,789 --> 01:03:08,960

right

1815

01:03:12,470 --> 01:03:10,799

so if a cev were to be a test would that

1816

01:03:14,789 --> 01:03:12,480

utilize one of those ports not

1817

01:03:17,190 --> 01:03:14,799

necessarily we could use the cbms

1818

01:03:18,710 --> 01:03:17,200

okay so you could add some configuration

1819

01:03:20,870 --> 01:03:18,720

change to allow for other people to come

1820

01:03:24,630 --> 01:03:20,880

in yes common birthing mechanism by the

1821

01:03:29,750 --> 01:03:27,589

well right now htv the the japanese

1822

01:03:31,750 --> 01:03:29,760

module and the europe the japanese

1823

01:03:33,670 --> 01:03:31,760

module comes up to station and is

1824

01:03:35,510 --> 01:03:33,680

birthed what that means is grabbed with

1825

01:03:36,309 --> 01:03:35,520

an arm and put onto what would normally

1826

01:03:37,510 --> 01:03:36,319

be a

1827

01:03:39,990 --> 01:03:37,520

another

1828

01:03:42,710 --> 01:03:40,000

module's port common birthing mechanism

1829

01:03:44,470 --> 01:03:42,720

built by boeing and uh it is not a

1830

01:03:46,710 --> 01:03:44,480

docking system it's not one a spacecraft

1831

01:03:49,190 --> 01:03:46,720

can just fly into

1832

01:03:51,109 --> 01:03:49,200

uh so and that's one way

1833

01:03:52,710 --> 01:03:51,119

for a vehicle to come to the station

1834

01:03:55,510 --> 01:03:52,720

it's not the way you'd bring crew to the

1835

01:03:57,510 --> 01:03:55,520

station because it needs to it's too

1836

01:03:59,510 --> 01:03:57,520

dependent on the arm that's bringing you

1837

01:04:01,670 --> 01:03:59,520

in but it's definitely a way you can

1838

01:04:03,750 --> 01:04:01,680

leave the station

1839

01:04:07,029 --> 01:04:03,760

so those ports for a lifeboat so the

1840

01:04:09,029 --> 01:04:07,039

lifeboat plan could use the cbm as a

1841

01:04:11,190 --> 01:04:09,039

port i believe

1842

01:04:12,150 --> 01:04:11,200

all right i'm sorry we got to end it

1843

01:04:13,349 --> 01:04:12,160

i wish we could take a few more

1844

01:04:15,990 --> 01:04:13,359

questions so thank you very much for