1
00:00:04,710 --> 00:00:01,990
uh good morning and welcome back to

2
00:00:06,630 --> 00:00:04,720
today's nasa future forum live from the

3
00:00:08,950 --> 00:00:06,640
university of maryland college park in

4
00:00:11,430 --> 00:00:08,960
the riggs alumni center i'm dave steves

5
00:00:13,830 --> 00:00:11,440
from nasa's office of communications

6
00:00:15,430 --> 00:00:13,840
we're now going to continue on with this

7
00:00:17,750 --> 00:00:15,440
morning's panelists

8
00:00:19,670 --> 00:00:17,760
we have our next panel titled technology

9
00:00:21,990 --> 00:00:19,680
and innovation unleashing the power of

10
00:00:24,390 --> 00:00:22,000
technology and creativity

11
00:00:26,150 --> 00:00:24,400
and the panel is going to be led by our

12
00:00:28,630 --> 00:00:26,160
own peter hughes who is the chief

13
00:00:30,550 --> 00:00:28,640

technologist at nasa's goddard space

14
00:00:31,910 --> 00:00:30,560
flight center in greenbelt maryland

15
00:00:33,510 --> 00:00:31,920
peter

16
00:00:35,350 --> 00:00:33,520
thank you

17
00:00:37,670 --> 00:00:35,360
so i'm quite honored to be here today to

18
00:00:39,190 --> 00:00:37,680
host this panel session on innovation

19
00:00:42,790 --> 00:00:39,200
and technology and how we go about

20
00:00:44,950 --> 00:00:42,800
unleashing the creative power of such

21
00:00:47,670 --> 00:00:44,960
before i do such i want to have a few

22
00:00:49,190 --> 00:00:47,680
introductory remarks about

23
00:00:51,510 --> 00:00:49,200
innovation and technology and some of

24
00:00:53,350 --> 00:00:51,520
the important milestones

25
00:00:55,110 --> 00:00:53,360
of course we heard earlier from charlie

26
00:00:57,750 --> 00:00:55,120
that we had a real critical milestone at

27
00:00:58,389 --> 00:00:57,760
the end of the chapter of this shuttle

28
00:01:00,389 --> 00:00:58,399
and

29
00:01:01,910 --> 00:01:00,399
granted it is a very bittersweet

30
00:01:03,510 --> 00:01:01,920
milestone

31
00:01:06,310 --> 00:01:03,520
but it's kind of eclipsed some other

32
00:01:09,030 --> 00:01:06,320
real important milestones recently

33
00:01:11,510 --> 00:01:09,040
one of which is that the agency now has

34
00:01:13,350 --> 00:01:11,520
a chief technologist dr bobby braun who

35
00:01:15,590 --> 00:01:13,360
we heard from this morning

36
00:01:18,630 --> 00:01:15,600
each of the centers have a center chief

37
00:01:20,950 --> 00:01:18,640
technologist that work with bobby and

38
00:01:23,030 --> 00:01:20,960

operate under the

39
00:01:25,030 --> 00:01:23,040
center technology council to provide

40
00:01:27,590 --> 00:01:25,040
them guidance and to work issues across

41
00:01:30,069 --> 00:01:27,600
centers providing guidance of the future

42
00:01:31,749 --> 00:01:30,079
directions of technologies

43
00:01:32,789 --> 00:01:31,759
but we also have an important milestone

44
00:01:34,950 --> 00:01:32,799
in the sense that we have a new

45
00:01:36,710 --> 00:01:34,960
organization at headquarters the office

46
00:01:38,950 --> 00:01:36,720
of chief technologist

47
00:01:41,910 --> 00:01:38,960
with budget we have some initial budget

48
00:01:43,830 --> 00:01:41,920
this year under the fy 11 operating plan

49
00:01:46,550 --> 00:01:43,840
and we have just released some very

50
00:01:48,870 --> 00:01:46,560
important awards to some students about

51
00:01:50,950 --> 00:01:48,880
80 students for the nasa

52
00:01:52,630 --> 00:01:50,960
space technology research fellowship

53
00:01:54,469 --> 00:01:52,640
this is a huge milestone we're going to

54
00:01:57,270 --> 00:01:54,479
engage students from across the nation

55
00:01:59,590 --> 00:01:57,280
and some very cutting edge technology

56
00:02:01,990 --> 00:01:59,600
earlier this week we just announced some

57
00:02:03,350 --> 00:02:02,000
new awards 40 awards or 30 awards for

58
00:02:05,429 --> 00:02:03,360
niacc

59
00:02:07,590 --> 00:02:05,439
some very creative

60
00:02:09,350 --> 00:02:07,600
almost implausible technologies that are

61
00:02:11,670 --> 00:02:09,360
going to create the new future and

62
00:02:14,949 --> 00:02:11,680
engage and inspire people the power of

63
00:02:18,630 --> 00:02:16,949

these are all very significant and it's

64
00:02:20,790 --> 00:02:18,640
in its further testament of the

65
00:02:23,270 --> 00:02:20,800
importance of us of continuing to focus

66
00:02:24,550 --> 00:02:23,280
on innovation and technology

67
00:02:26,630 --> 00:02:24,560
i think no one in this room will

68
00:02:28,710 --> 00:02:26,640
disagree that innovation and technology

69
00:02:30,869 --> 00:02:28,720
is important we all can have our own

70
00:02:33,030 --> 00:02:30,879
perspective how how to go about

71
00:02:34,630 --> 00:02:33,040
innovation and technology

72
00:02:36,869 --> 00:02:34,640
what i've assembled here today is a

73
00:02:38,630 --> 00:02:36,879
panel with people from

74
00:02:40,630 --> 00:02:38,640
across the enterprise and nasa

75
00:02:42,550 --> 00:02:40,640
enterprise from within the agency from

76
00:02:44,630 --> 00:02:42,560
industry and academia they're going to

77
00:02:47,110 --> 00:02:44,640
give different perspectives on how we

78
00:02:48,790 --> 00:02:47,120
stimulate creativity and innovation and

79
00:02:51,830 --> 00:02:48,800
different perspectives of how we could

80
00:02:55,110 --> 00:02:51,840
bring in the broader set of innovators

81
00:02:57,190 --> 00:02:55,120
from throughout the nation and beyond

82
00:02:59,509 --> 00:02:57,200
we're going to start the panel this this

83
00:03:01,270 --> 00:02:59,519
morning with mr joe parrish who's the

84
00:03:03,589 --> 00:03:01,280
director of early stage innovation in

85
00:03:05,350 --> 00:03:03,599
the office of chief technologist

86
00:03:07,110 --> 00:03:05,360
he has a very

87
00:03:09,750 --> 00:03:07,120
broad background

88
00:03:13,270 --> 00:03:09,760

working space flight programs worked at

89
00:03:16,149 --> 00:03:13,280
jpl he also worked an industry he was a

90
00:03:18,550 --> 00:03:16,159
performer in sbir program

91
00:03:20,309 --> 00:03:18,560
just a great example of someone who's

92
00:03:23,350 --> 00:03:20,319
jumped around throughout the industry to

93
00:03:25,990 --> 00:03:23,360
help contribute to our nasa program

94
00:03:27,270 --> 00:03:26,000
um when i spoke to him and as i did with

95
00:03:28,789 --> 00:03:27,280
every panelist i tried to get a little

96
00:03:31,270 --> 00:03:28,799
tidbit that was unique about that

97
00:03:33,430 --> 00:03:31,280
individual and i found out that he has a

98
00:03:34,789 --> 00:03:33,440
twin brother i also found out he's an

99
00:03:35,670 --> 00:03:34,799
avid pilot

100
00:03:38,470 --> 00:03:35,680
hang

101
00:03:41,350 --> 00:03:38,480
and glider uh for gliders

102
00:03:43,110 --> 00:03:41,360
um but he also flies up a small

103
00:03:44,309 --> 00:03:43,120
hand-built

104
00:03:48,070 --> 00:03:44,319
um

105
00:03:49,750 --> 00:03:48,080
plane a you know a small custom plane

106
00:03:52,630 --> 00:03:49,760
and he's so

107
00:03:55,030 --> 00:03:52,640
so trusting of his brother his twin

108
00:03:56,630 --> 00:03:55,040
brother was one who made this plane i

109
00:03:58,869 --> 00:03:56,640
find that quite remarkable to trust his

110
00:04:01,270 --> 00:03:58,879
brother so much to put his whole his

111
00:04:02,550 --> 00:04:01,280
hands into his brother's ability to

112
00:04:04,070 --> 00:04:02,560
build something

113
00:04:05,990 --> 00:04:04,080

so joe

114
00:04:08,390 --> 00:04:06,000
joe's going to talk a bit about how we

115
00:04:09,750 --> 00:04:08,400
plan to engage a wide spectrum of

116
00:04:13,190 --> 00:04:09,760
innovators throughout the space

117
00:04:15,429 --> 00:04:13,200
enterprise for innovation and technology

118
00:04:17,830 --> 00:04:15,439
great thank you very much peter and the

119
00:04:20,150 --> 00:04:17,840
only remark i would add to the the

120
00:04:21,509 --> 00:04:20,160
little personal note about my my twin

121
00:04:22,629 --> 00:04:21,519
brother the only thing i can really say

122
00:04:24,469 --> 00:04:22,639
about him in addition to being an

123
00:04:26,310 --> 00:04:24,479
excellent aircraft builder he's an

124
00:04:29,909 --> 00:04:26,320
incredibly handsome guy

125
00:04:33,590 --> 00:04:29,919
uh and so those two those two qualities

126
00:04:35,189 --> 00:04:33,600
really uh define him uh to to really get

127
00:04:37,110 --> 00:04:35,199
to the much more interesting and

128
00:04:39,749 --> 00:04:37,120
important point i i wanted to talk a

129
00:04:43,110 --> 00:04:39,759
little bit about uh how we can foster

130
00:04:45,350 --> 00:04:43,120
innovation and how we

131
00:04:46,870 --> 00:04:45,360
tap into the

132
00:04:49,670 --> 00:04:46,880
broadest possible spectrum of

133
00:04:51,590 --> 00:04:49,680
participants in innovation and one of

134
00:04:54,070 --> 00:04:51,600
one of the most important fundamental

135
00:04:55,990 --> 00:04:54,080
things to to realize about innovation is

136
00:04:59,030 --> 00:04:56,000
some of the things that we do in nasa

137
00:05:01,510 --> 00:04:59,040
are very resource and capital intensive

138
00:05:04,390 --> 00:05:01,520

you know it takes hundreds or thousands

139
00:05:05,749 --> 00:05:04,400
of people to to launch a rocket into

140
00:05:06,870 --> 00:05:05,759
space

141
00:05:09,510 --> 00:05:06,880
and

142
00:05:11,510 --> 00:05:09,520
those activities just by their very

143
00:05:14,790 --> 00:05:11,520
nature can sort of only be performed by

144
00:05:17,189 --> 00:05:14,800
a handful of of organizations

145
00:05:19,270 --> 00:05:17,199
but when we back up and we think about

146
00:05:20,710 --> 00:05:19,280
innovation and we think about the the

147
00:05:23,350 --> 00:05:20,720
fundamentalized

148
00:05:26,230 --> 00:05:23,360
notion of taking ideas

149
00:05:27,350 --> 00:05:26,240
and applying them to to challenging

150
00:05:29,749 --> 00:05:27,360
problems

151
00:05:31,830 --> 00:05:29,759
innovation doesn't require any capital

152
00:05:34,870 --> 00:05:31,840
innovation doesn't require giant teams

153
00:05:37,350 --> 00:05:34,880
it comes from our individual brains

154
00:05:38,550 --> 00:05:37,360
and all of us are equipped with that we

155
00:05:41,189 --> 00:05:38,560
just have to

156
00:05:43,670 --> 00:05:41,199
spend those uh those mental clock cycles

157
00:05:46,070 --> 00:05:43,680
in in application to these these

158
00:05:49,350 --> 00:05:46,080
challenging problems and so one thing i

159
00:05:51,590 --> 00:05:49,360
think that nasa has done really nicely

160
00:05:53,590 --> 00:05:51,600
especially with in recent emphasis in

161
00:05:55,749 --> 00:05:53,600
developing our programs in space

162
00:05:58,150 --> 00:05:55,759
technology and peter mentioned them the

163
00:06:00,790 --> 00:05:58,160

administrator mentioned some of them

164
00:06:02,790 --> 00:06:00,800
earlier and our panelists earlier today

165
00:06:05,830 --> 00:06:02,800
have mentioned them we're approaching

166
00:06:07,510 --> 00:06:05,840
the innovation process from a variety of

167
00:06:09,510 --> 00:06:07,520
perspectives and and just within the

168
00:06:13,430 --> 00:06:09,520
office of the chief technologist we have

169
00:06:16,070 --> 00:06:13,440
a variety of programs that try to

170
00:06:18,070 --> 00:06:16,080
engage different segments of the

171
00:06:19,350 --> 00:06:18,080
aerospace community but even the broader

172
00:06:21,590 --> 00:06:19,360
population

173
00:06:23,029 --> 00:06:21,600
in the innovation process and the one

174
00:06:25,270 --> 00:06:23,039
that i think is one of the most

175
00:06:28,189 --> 00:06:25,280
wonderful examples is our centennial

176
00:06:29,749 --> 00:06:28,199
challenges program that is a

177
00:06:32,230 --> 00:06:29,759
prize-oriented

178
00:06:34,629 --> 00:06:32,240
program where nasa

179
00:06:36,390 --> 00:06:34,639
establishes prizes for the achievement

180
00:06:37,670 --> 00:06:36,400
of challenging

181
00:06:39,029 --> 00:06:37,680
objectives

182
00:06:40,230 --> 00:06:39,039
and

183
00:06:43,510 --> 00:06:40,240
the

184
00:06:46,230 --> 00:06:43,520
prize competitions are open to anyone in

185
00:06:49,189 --> 00:06:46,240
the country to come and participate

186
00:06:50,870 --> 00:06:49,199
and in fact uh some of the most

187
00:06:53,110 --> 00:06:50,880
incredible achievements on the way to

188
00:06:55,510 --> 00:06:53,120

winning these prizes have been achieved

189
00:06:57,110 --> 00:06:55,520
by individuals operating in their in

190
00:06:59,510 --> 00:06:57,120
their homes in their on their dining

191
00:07:01,589 --> 00:06:59,520
room tables and their garages to come up

192
00:07:03,830 --> 00:07:01,599
with new approaches to solving some of

193
00:07:05,589 --> 00:07:03,840
the problems that have vexed nasa for

194
00:07:07,990 --> 00:07:05,599
the the last 20 years and we call this

195
00:07:10,790 --> 00:07:08,000
program the one that that uh is trying

196
00:07:12,309 --> 00:07:10,800
to engage the citizen inventor

197
00:07:13,909 --> 00:07:12,319
and i think that uh

198
00:07:15,110 --> 00:07:13,919
it's it's really a remarkable

199
00:07:18,710 --> 00:07:15,120
opportunity we're about to have a

200
00:07:19,510 --> 00:07:18,720
competition in california in september

201
00:07:25,749 --> 00:07:19,520
to

202
00:07:28,390 --> 00:07:25,759
efficiency of general aviation aircraft

203
00:07:31,589 --> 00:07:28,400
looking for 5 to 10x improvement over

204
00:07:34,309 --> 00:07:31,599
the current state of the art in general

205
00:07:35,350 --> 00:07:34,319
aviation aircraft efficiency and that

206
00:07:37,670 --> 00:07:35,360
prize

207
00:07:39,990 --> 00:07:37,680
is a million and a half dollars

208
00:07:42,309 --> 00:07:40,000
offered by nasa to someone who can

209
00:07:44,469 --> 00:07:42,319
develop an aircraft that can achieve 200

210
00:07:47,909 --> 00:07:44,479
passenger miles per gallon where a

211
00:07:50,070 --> 00:07:47,919
cessna gets about 20 right now

212
00:07:51,589 --> 00:07:50,080
we have some other programs and

213
00:07:53,270 --> 00:07:51,599

different approaches that are a little

214
00:07:55,189 --> 00:07:53,280
narrower in scope but when i when i sort

215
00:07:57,189 --> 00:07:55,199
of rattle these off quickly you'll get

216
00:07:59,270 --> 00:07:57,199
the impression that we're coming at it

217
00:08:01,430 --> 00:07:59,280
from so many different directions that

218
00:08:04,390 --> 00:08:01,440
we really managed to to capture the full

219
00:08:07,270 --> 00:08:04,400
spectrum the the niacc program peter

220
00:08:08,869 --> 00:08:07,280
just mentioned we issued 30 awards

221
00:08:11,510 --> 00:08:08,879
the the barrier to entry into that

222
00:08:13,189 --> 00:08:11,520
program was was remarkably lows a nine

223
00:08:14,710 --> 00:08:13,199
page proposal that could be written by

224
00:08:18,230 --> 00:08:14,720
anybody and we got

225
00:08:22,309 --> 00:08:18,240
hundreds of proposals from academia from

226
00:08:24,790 --> 00:08:22,319
industry from small businesses from nasa

227
00:08:26,309 --> 00:08:24,800
and we have 30 projects any one of which

228
00:08:28,710 --> 00:08:26,319
if they were successful would really be

229
00:08:30,469 --> 00:08:28,720
revolutionary and would completely

230
00:08:32,790 --> 00:08:30,479
change the way that we approach space

231
00:08:34,230 --> 00:08:32,800
exploration or mitigation of orbital

232
00:08:35,670 --> 00:08:34,240
debris

233
00:08:37,190 --> 00:08:35,680
a number of different challenges are

234
00:08:38,709 --> 00:08:37,200
being addressed in this program and that

235
00:08:40,790 --> 00:08:38,719
was open to anyone who wanted to

236
00:08:43,029 --> 00:08:40,800
participate from anyone in the nation

237
00:08:45,350 --> 00:08:43,039
who wanted to to participate

238
00:08:47,110 --> 00:08:45,360

we have the sbir program which is a

239
00:08:49,030 --> 00:08:47,120
little bit narrower in terms of the the

240
00:08:50,870 --> 00:08:49,040
the entities that can engage is oriented

241
00:08:52,470 --> 00:08:50,880
towards small businesses and the reason

242
00:08:54,870 --> 00:08:52,480
for that is the small businesses are

243
00:08:57,190 --> 00:08:54,880
really one of the major

244
00:09:00,790 --> 00:08:57,200
engines in innovation in the country

245
00:09:03,110 --> 00:09:00,800
these businesses that are 10 people or

246
00:09:05,269 --> 00:09:03,120
50 people or 100 people even when

247
00:09:07,269 --> 00:09:05,279
they're starting to to build and grow in

248
00:09:10,070 --> 00:09:07,279
their in their size

249
00:09:12,710 --> 00:09:10,080
are so agile and able to respond quickly

250
00:09:13,509 --> 00:09:12,720
and able to look into other areas

251
00:09:16,070 --> 00:09:13,519
for

252
00:09:20,230 --> 00:09:16,080
ideas that can be transferred and

253
00:09:22,389 --> 00:09:20,240
applied to to new problems that nasa has

254
00:09:24,949 --> 00:09:22,399
we have

255
00:09:26,870 --> 00:09:24,959
uh the center innovation fund which uh

256
00:09:29,269 --> 00:09:26,880
peter actually administers on on behalf

257
00:09:31,590 --> 00:09:29,279
of the goddard space flight center we

258
00:09:33,990 --> 00:09:31,600
also are providing funding to all of the

259
00:09:36,230 --> 00:09:34,000
other nasa centers to tap into the

260
00:09:38,470 --> 00:09:36,240
creative energies of the people at the

261
00:09:40,230 --> 00:09:38,480
nasa centers who really are are in the

262
00:09:42,790 --> 00:09:40,240
trenches on a daily basis trying to

263
00:09:44,230 --> 00:09:42,800

address nasa problems so i've only

264
00:09:45,910 --> 00:09:44,240
mentioned a few and i wanted to close

265
00:09:47,910 --> 00:09:45,920
with just one that's been mentioned a

266
00:09:49,990 --> 00:09:47,920
few times today because we're in an

267
00:09:52,310 --> 00:09:50,000
academic setting i really have to talk a

268
00:09:54,710 --> 00:09:52,320
little bit about the space technology

269
00:09:56,389 --> 00:09:54,720
research fellowships program and claudia

270
00:09:57,829 --> 00:09:56,399
meyer who's the program executive for

271
00:09:59,829 --> 00:09:57,839
that program and has really been the

272
00:10:01,670 --> 00:09:59,839
shepherd of that idea she's in the

273
00:10:03,509 --> 00:10:01,680
audience today greatly appreciative

274
00:10:07,030 --> 00:10:03,519
everything that she's done to make that

275
00:10:08,230 --> 00:10:07,040
happen but last month we selected 80

276
00:10:10,230 --> 00:10:08,240
brilliant

277
00:10:12,630 --> 00:10:10,240
young innovators who are going to be the

278
00:10:13,990 --> 00:10:12,640
future of nasa's innovation

279
00:10:16,829 --> 00:10:14,000
uh

280
00:10:19,030 --> 00:10:16,839
and we have this this really cool little

281
00:10:20,630 --> 00:10:19,040
slogan and it's

282
00:10:23,190 --> 00:10:20,640
go to school

283
00:10:25,269 --> 00:10:23,200
invent technology

284
00:10:27,030 --> 00:10:25,279
define the future

285
00:10:28,310 --> 00:10:27,040
save the world

286
00:10:29,350 --> 00:10:28,320
and you start out at the beginning of

287
00:10:31,750 --> 00:10:29,360
that and you say go to school that

288
00:10:33,430 --> 00:10:31,760

sounds kind of easy right go to school

289
00:10:35,269 --> 00:10:33,440
and then invent technology well yeah

290
00:10:36,790 --> 00:10:35,279
we're all about that and then you get to

291
00:10:39,269 --> 00:10:36,800
the part where you're talking about save

292
00:10:40,470 --> 00:10:39,279
the world and it seems hard

293
00:10:43,030 --> 00:10:40,480
but you know when you start at the

294
00:10:45,110 --> 00:10:43,040
beginning and you take one step

295
00:10:47,269 --> 00:10:45,120
it's not impossible to think about one

296
00:10:49,590 --> 00:10:47,279
of these brilliant young people

297
00:10:51,110 --> 00:10:49,600
pursuing a solution to

298
00:10:52,949 --> 00:10:51,120
mitigating an asteroid that could

299
00:10:54,790 --> 00:10:52,959
threaten our planet we're making

300
00:10:57,350 --> 00:10:54,800
possible the colonization of other

301
00:10:59,269 --> 00:10:57,360
planets so if for one reason or another

302
00:11:01,750 --> 00:10:59,279
this planet becomes too crowded or too

303
00:11:03,509 --> 00:11:01,760
difficult to populate we can migrate to

304
00:11:06,069 --> 00:11:03,519
another one now these are ideas that are

305
00:11:07,670 --> 00:11:06,079
not going to be realized for for decades

306
00:11:09,829 --> 00:11:07,680
but we have to get started today in

307
00:11:11,590 --> 00:11:09,839
doing that and space technology research

308
00:11:14,230 --> 00:11:11,600
fellowships program

309
00:11:16,949 --> 00:11:14,240
with the inaugural class of 80 is a

310
00:11:19,269 --> 00:11:16,959
magnificent way of getting started

311
00:11:20,949 --> 00:11:19,279
on on that path and

312
00:11:22,790 --> 00:11:20,959
the other cool thing is that dr ray

313
00:11:25,110 --> 00:11:22,800

sedwick who actually had a very

314
00:11:26,470 --> 00:11:25,120
insightful question earlier today is a

315
00:11:28,310 --> 00:11:26,480
professor here at the university of

316
00:11:30,150 --> 00:11:28,320
maryland one of his graduate students

317
00:11:31,670 --> 00:11:30,160
won one of these fellowships so he and

318
00:11:33,590 --> 00:11:31,680
claudia have been talking about how to

319
00:11:36,069 --> 00:11:33,600
make best use of this brilliant new

320
00:11:37,509 --> 00:11:36,079
researcher so

321
00:11:39,670 --> 00:11:37,519
let me conclude by saying that i've only

322
00:11:40,870 --> 00:11:39,680
given you a small snapshot of a number

323
00:11:43,829 --> 00:11:40,880
of the different ways that we're

324
00:11:45,590 --> 00:11:43,839
approaching the the development of

325
00:11:47,430 --> 00:11:45,600
technology the ways that we're trying to

326
00:11:48,470 --> 00:11:47,440
foster innovation from the broadest

327
00:11:51,350 --> 00:11:48,480
possible

328
00:11:53,030 --> 00:11:51,360
spectrum of not just our aerospace

329
00:11:55,269 --> 00:11:53,040
community because as

330
00:11:57,910 --> 00:11:55,279
as ray said earlier it's a rather small

331
00:11:59,750 --> 00:11:57,920
slice of it but broadening out to all of

332
00:12:03,030 --> 00:11:59,760
the nation and getting people to think

333
00:12:05,590 --> 00:12:03,040
about how to solve nasa's big problems

334
00:12:07,509 --> 00:12:05,600
so thank you great thanks joe

335
00:12:09,750 --> 00:12:07,519
so for our next speaker we have miss

336
00:12:12,230 --> 00:12:09,760
jennifer byrne from lockheed martin

337
00:12:13,910 --> 00:12:12,240
she's a vp of corporate engineering and

338
00:12:16,389 --> 00:12:13,920

technology

339
00:12:18,710 --> 00:12:16,399
jen's a science and engine engineer by

340
00:12:20,310 --> 00:12:18,720
training she has program management and

341
00:12:22,790 --> 00:12:20,320
technical leadership experience for

342
00:12:24,230 --> 00:12:22,800
complex very large scale systems

343
00:12:26,230 --> 00:12:24,240
i mean talking with her try to

344
00:12:27,750 --> 00:12:26,240
understand what her advocations were i

345
00:12:28,629 --> 00:12:27,760
was asking what she does in her spare

346
00:12:30,069 --> 00:12:28,639
time

347
00:12:31,750 --> 00:12:30,079
she kind of laughed at it and said she

348
00:12:34,710 --> 00:12:31,760
doesn't have spare time

349
00:12:37,269 --> 00:12:34,720
it's because she's pursuing a phd at gw

350
00:12:39,269 --> 00:12:37,279
university in systems engineering and a

351
00:12:41,990 --> 00:12:39,279
really interesting topic of

352
00:12:43,750 --> 00:12:42,000
optical cochlear implants

353
00:12:46,150 --> 00:12:43,760
and how we can

354
00:12:48,470 --> 00:12:46,160
explore new ways to fire the nerves

355
00:12:49,990 --> 00:12:48,480
using optical signals as opposed to like

356
00:12:53,110 --> 00:12:50,000
you know other

357
00:12:55,110 --> 00:12:53,120
electrical signals using very advanced

358
00:12:56,629 --> 00:12:55,120
techniques for modeling and simulation

359
00:12:58,949 --> 00:12:56,639
to understand this phenomena and how it

360
00:13:00,790 --> 00:12:58,959
might work but a great example of how we

361
00:13:02,790 --> 00:13:00,800
could take a cross-cutting set of

362
00:13:03,750 --> 00:13:02,800
technologies and apply it to our daily

363
00:13:05,509 --> 00:13:03,760

life

364
00:13:07,829 --> 00:13:05,519
so jen's agreed to talk about how

365
00:13:09,350 --> 00:13:07,839
collaboration can positively impact

366
00:13:12,069 --> 00:13:09,360
innovation

367
00:13:14,470 --> 00:13:12,079
thank you peter and probably all of my

368
00:13:17,509 --> 00:13:14,480
professors are watching me on television

369
00:13:19,350 --> 00:13:17,519
and saying shouldn't she be studying

370
00:13:21,269 --> 00:13:19,360
probably

371
00:13:24,389 --> 00:13:21,279
and so i think it's a really important

372
00:13:26,230 --> 00:13:24,399
topic to think about uh collaboration

373
00:13:28,790 --> 00:13:26,240
enabling innovation

374
00:13:31,430 --> 00:13:28,800
because innovation requires

375
00:13:33,910 --> 00:13:31,440
thinking differently if you think about

376
00:13:36,629 --> 00:13:33,920
some of the major innovations that we've

377
00:13:38,870 --> 00:13:36,639
we've experienced over the past

378
00:13:42,230 --> 00:13:38,880
50 years or so

379
00:13:44,870 --> 00:13:42,240
a few come to mind one is einstein and

380
00:13:47,269 --> 00:13:44,880
the theory of relativity and it really

381
00:13:50,629 --> 00:13:47,279
came because he had to think about time

382
00:13:53,350 --> 00:13:50,639
differently there was um an inability on

383
00:13:55,750 --> 00:13:53,360
his part to to really process the

384
00:13:58,470 --> 00:13:55,760
concept of time and so he really went

385
00:14:00,230 --> 00:13:58,480
about that mathematically and and

386
00:14:03,750 --> 00:14:00,240
invented a new discipline

387
00:14:05,750 --> 00:14:03,760
uh same thing with fourier optics

388
00:14:08,389 --> 00:14:05,760

you know we used to look at wave tracing

389
00:14:10,150 --> 00:14:08,399
and that's kind of my background is

390
00:14:12,389 --> 00:14:10,160
coherent imaging

391
00:14:13,670 --> 00:14:12,399
but fourier optics really changed that

392
00:14:16,150 --> 00:14:13,680
field

393
00:14:17,509 --> 00:14:16,160
because it was a blend of mathematics

394
00:14:18,870 --> 00:14:17,519
and optics

395
00:14:21,189 --> 00:14:18,880
so

396
00:14:23,590 --> 00:14:21,199
that's the the thing the thinking

397
00:14:27,269 --> 00:14:23,600
thinking differently is really important

398
00:14:28,949 --> 00:14:27,279
and so if you think about collaboration

399
00:14:31,910 --> 00:14:28,959
what collaboration gives us

400
00:14:35,030 --> 00:14:31,920
automatically is diversity and nature

401
00:14:37,509 --> 00:14:35,040
loves diversity uh diversity of thought

402
00:14:38,790 --> 00:14:37,519
background education

403
00:14:40,629 --> 00:14:38,800
and

404
00:14:43,269 --> 00:14:40,639
specifically is one of the reasons one

405
00:14:44,389 --> 00:14:43,279
of the many reasons that we need to

406
00:14:45,310 --> 00:14:44,399
increase

407
00:14:48,870 --> 00:14:45,320
the

408
00:14:51,350 --> 00:14:48,880
underrepresented populations in science

409
00:14:54,389 --> 00:14:51,360
technology engineering and mathematics

410
00:14:58,230 --> 00:14:54,399
because that diversity of perspective

411
00:15:00,790 --> 00:14:58,240
gets us better solutions and gets that

412
00:15:03,110 --> 00:15:00,800
different thinking

413
00:15:05,350 --> 00:15:03,120

the collaboration is really important

414
00:15:07,590 --> 00:15:05,360
because when you collaborate across

415
00:15:10,310 --> 00:15:07,600
boundaries you're automatically getting

416
00:15:13,750 --> 00:15:10,320
that diversity of perspective and as a

417
00:15:15,269 --> 00:15:13,760
group the group becomes more intelligent

418
00:15:17,829 --> 00:15:15,279
and so i call that collective

419
00:15:20,790 --> 00:15:17,839
intelligence it's kind of ironic because

420
00:15:22,310 --> 00:15:20,800
we're just talking about uh me going for

421
00:15:25,030 --> 00:15:22,320
my phd

422
00:15:28,069 --> 00:15:25,040
and and we spend a lot of time

423
00:15:30,629 --> 00:15:28,079
in in trying to increase individual

424
00:15:32,870 --> 00:15:30,639
intelligence through education

425
00:15:35,829 --> 00:15:32,880
and through you know various other types

426
00:15:38,710 --> 00:15:35,839
of training uh as a leader in in a

427
00:15:41,670 --> 00:15:38,720
technology world i feel one of our

428
00:15:44,150 --> 00:15:41,680
greatest untapped resources is

429
00:15:46,550 --> 00:15:44,160
collective intelligence and it doesn't

430
00:15:50,710 --> 00:15:46,560
come automatically it's not just

431
00:15:52,629 --> 00:15:50,720
bringing diverse groups together because

432
00:15:54,870 --> 00:15:52,639
you know if i think one way and you

433
00:15:57,110 --> 00:15:54,880
think a different way

434
00:15:59,189 --> 00:15:57,120
there's there's a discomfort that comes

435
00:16:02,150 --> 00:15:59,199
from that when when somebody is is

436
00:16:04,550 --> 00:16:02,160
challenging kind of your mindset

437
00:16:07,030 --> 00:16:04,560
so as leaders it's really important that

438
00:16:10,310 --> 00:16:07,040

we develop these new ways of bringing

439
00:16:13,910 --> 00:16:10,320
together diverse teams to collaborate

440
00:16:16,470 --> 00:16:13,920
and everyone feels valued uh because the

441
00:16:18,310 --> 00:16:16,480
overall solution is about our solution

442
00:16:21,590 --> 00:16:18,320
so that that was the point i'd like to

443
00:16:23,350 --> 00:16:21,600
make and uh thank you great thank you

444
00:16:25,590 --> 00:16:23,360
it's actually a great segue to our next

445
00:16:28,150 --> 00:16:25,600
speaker who's dr pat o'shea is a vp for

446
00:16:29,749 --> 00:16:28,160
research and a senior research official

447
00:16:30,790 --> 00:16:29,759
here at university of maryland college

448
00:16:33,829 --> 00:16:30,800
park

449
00:16:37,110 --> 00:16:33,839
um has a varied background in academia

450
00:16:39,590 --> 00:16:37,120
also worked at los alamos national labs

451
00:16:41,269 --> 00:16:39,600
where he explained one of the

452
00:16:43,590 --> 00:16:41,279
most interesting and one of the funnest

453
00:16:45,910 --> 00:16:43,600
jobs he had where he was the

454
00:16:48,710 --> 00:16:45,920
launch pad chief down

455
00:16:51,189 --> 00:16:48,720
at white sands for some early experi

456
00:16:53,430 --> 00:16:51,199
early experiments in space physics for

457
00:16:56,069 --> 00:16:53,440
the dod

458
00:16:56,949 --> 00:16:56,079
pat has agreed to talk about how we how

459
00:16:57,910 --> 00:16:56,959
we

460
00:17:00,389 --> 00:16:57,920
um

461
00:17:02,550 --> 00:17:00,399
how the university play a role in r t

462
00:17:05,750 --> 00:17:02,560
and developing our next generation of

463
00:17:08,230 --> 00:17:05,760

innovators thank you peter

464
00:17:10,549 --> 00:17:08,240
i've been vice president for research

465
00:17:12,549 --> 00:17:10,559
here at the university of maryland for

466
00:17:13,590 --> 00:17:12,559
six weeks in fact it'll be six weeks

467
00:17:15,990 --> 00:17:13,600
tomorrow

468
00:17:19,510 --> 00:17:16,000
and so people ask me what does a vice

469
00:17:21,590 --> 00:17:19,520
president for research do and i've found

470
00:17:23,750 --> 00:17:21,600
in answering that question it's not so

471
00:17:26,470 --> 00:17:23,760
much what i do as a vice president but

472
00:17:28,870 --> 00:17:26,480
what is a research university and what

473
00:17:31,270 --> 00:17:28,880
is the role of a research university in

474
00:17:32,390 --> 00:17:31,280
society

475
00:17:33,430 --> 00:17:32,400
there are about

476
00:17:36,549 --> 00:17:33,440
2

477
00:17:38,310 --> 00:17:36,559
600 four-year colleges and universities

478
00:17:40,950 --> 00:17:38,320
in the united states

479
00:17:43,029 --> 00:17:40,960
but a very small fraction of those are

480
00:17:45,510 --> 00:17:43,039
research universities

481
00:17:47,029 --> 00:17:45,520
if you look at the american association

482
00:17:50,470 --> 00:17:47,039
of universities which is the

483
00:17:52,870 --> 00:17:50,480
organization that represents the major

484
00:17:55,830 --> 00:17:52,880
extensive research universities in the

485
00:17:58,630 --> 00:17:55,840
united states it only has 61 members

486
00:18:01,430 --> 00:17:58,640
that's a very very small

487
00:18:03,270 --> 00:18:01,440
fraction of the total number of

488
00:18:05,750 --> 00:18:03,280

colleges and universities in the united

489
00:18:08,310 --> 00:18:05,760
states so research universities

490
00:18:11,190 --> 00:18:08,320
are in the business of doing three

491
00:18:13,590 --> 00:18:11,200
things in closing a triangle

492
00:18:14,870 --> 00:18:13,600
one is doing research which is the

493
00:18:17,029 --> 00:18:14,880
creation

494
00:18:19,750 --> 00:18:17,039
of knowledge and technology

495
00:18:21,669 --> 00:18:19,760
the other is education which is the

496
00:18:23,750 --> 00:18:21,679
passing of that new knowledge and

497
00:18:25,830 --> 00:18:23,760
technology onto students

498
00:18:27,590 --> 00:18:25,840
and the third is service which is

499
00:18:29,510 --> 00:18:27,600
connecting that research in education

500
00:18:32,070 --> 00:18:29,520
and producing output

501
00:18:34,630 --> 00:18:32,080
through both the educated students

502
00:18:36,470 --> 00:18:34,640
and the technology that we develop and

503
00:18:37,590 --> 00:18:36,480
transferring that to

504
00:18:38,710 --> 00:18:37,600
industry

505
00:18:39,510 --> 00:18:38,720
and

506
00:18:40,710 --> 00:18:39,520
to

507
00:18:42,789 --> 00:18:40,720
government

508
00:18:45,350 --> 00:18:42,799
and there as i said very few

509
00:18:48,150 --> 00:18:45,360
universities in the country would really

510
00:18:50,310 --> 00:18:48,160
take the three aspects of that uh

511
00:18:52,710 --> 00:18:50,320
seriously and when it comes to the type

512
00:18:55,350 --> 00:18:52,720
of technologies we're talking about

513
00:18:58,950 --> 00:18:55,360

today for nasa these technologies are

514
00:19:01,990 --> 00:18:58,960
very rapidly evolving so that

515
00:19:04,310 --> 00:19:02,000
when students come in to the university

516
00:19:07,270 --> 00:19:04,320
in the fall and when they leave

517
00:19:10,470 --> 00:19:07,280
four years from now there will be jobs

518
00:19:12,870 --> 00:19:10,480
available for them that did not exist

519
00:19:14,870 --> 00:19:12,880
when they came in remember you know

520
00:19:16,710 --> 00:19:14,880
facebook one of the biggest companies in

521
00:19:19,669 --> 00:19:16,720
the united states that was only founded

522
00:19:21,350 --> 00:19:19,679
a few years ago it didn't exist in 2004

523
00:19:23,590 --> 00:19:21,360
2005.

524
00:19:24,549 --> 00:19:23,600
so we are training and educating

525
00:19:25,430 --> 00:19:24,559
students

526
00:19:28,150 --> 00:19:25,440
for

527
00:19:30,549 --> 00:19:28,160
jobs that

528
00:19:32,789 --> 00:19:30,559
do not exist for technologies that are

529
00:19:34,230 --> 00:19:32,799
not yet named so at research

530
00:19:36,950 --> 00:19:34,240
universities

531
00:19:39,909 --> 00:19:36,960
we are in the business of educating

532
00:19:41,350 --> 00:19:39,919
explorers and not simply training

533
00:19:45,029 --> 00:19:41,360
tourists

534
00:19:46,789 --> 00:19:45,039
because explorers synthesize knowledge

535
00:19:48,150 --> 00:19:46,799
explorers

536
00:19:49,430 --> 00:19:48,160
observe

537
00:19:53,029 --> 00:19:49,440
question

538
00:19:55,430 --> 00:19:53,039

associate associate network and

539
00:19:58,230 --> 00:19:55,440
experiment to quote

540
00:19:59,110 --> 00:19:58,240
a new book called innovators dna

541
00:20:01,750 --> 00:19:59,120
they

542
00:20:04,789 --> 00:20:01,760
go beyond the map

543
00:20:07,270 --> 00:20:04,799
whereas tourists work very much within

544
00:20:09,750 --> 00:20:07,280
the map so

545
00:20:11,590 --> 00:20:09,760
at the major research universities we

546
00:20:14,070 --> 00:20:11,600
try to break down the silos we don't

547
00:20:16,870 --> 00:20:14,080
just talk about multi-disciplinary or

548
00:20:18,950 --> 00:20:16,880
interdisciplinary research and education

549
00:20:21,669 --> 00:20:18,960
we talk about transdisciplinary which

550
00:20:25,029 --> 00:20:21,679
goes beyond the tradition

551
00:20:27,430 --> 00:20:25,039
nobody ever received an education in the

552
00:20:29,270 --> 00:20:27,440
classroom if i actually think of how

553
00:20:31,110 --> 00:20:29,280
much i remember from my undergraduate

554
00:20:33,750 --> 00:20:31,120
education i could probably fit it on one

555
00:20:35,870 --> 00:20:33,760
page it's what i learned outside the

556
00:20:38,070 --> 00:20:35,880
classroom we used to call it

557
00:20:40,390 --> 00:20:38,080
extracurricular activity but at the

558
00:20:43,270 --> 00:20:40,400
research universities we're making the

559
00:20:45,669 --> 00:20:43,280
extracurricular activities part of the

560
00:20:47,830 --> 00:20:45,679
curriculum that is competition-based

561
00:20:49,190 --> 00:20:47,840
learning

562
00:20:50,950 --> 00:20:49,200
teams

563
00:20:53,990 --> 00:20:50,960

we have at the university of maryland

564
00:20:56,310 --> 00:20:54,000
the very first class for engineers is an

565
00:20:58,149 --> 00:20:56,320
introduction to engineering design where

566
00:20:59,590 --> 00:20:58,159
students have to design and build a

567
00:21:01,909 --> 00:20:59,600
hovercraft

568
00:21:04,230 --> 00:21:01,919
and their final grace grade is based on

569
00:21:05,909 --> 00:21:04,240
a public competition that they have to

570
00:21:07,510 --> 00:21:05,919
engage in in front of the public and

571
00:21:08,950 --> 00:21:07,520
that is very stimulating because it

572
00:21:10,870 --> 00:21:08,960
brings together a large number of

573
00:21:12,789 --> 00:21:10,880
students and teams that would not

574
00:21:13,510 --> 00:21:12,799
ordinarily get together but it trains

575
00:21:17,990 --> 00:21:13,520
them

576
00:21:20,070 --> 00:21:18,000
world environment the other thing we're

577
00:21:22,149 --> 00:21:20,080
trying to do is create at research

578
00:21:25,669 --> 00:21:22,159
universities an academic environment

579
00:21:27,350 --> 00:21:25,679
that promotes and rewards innovation

580
00:21:29,750 --> 00:21:27,360
and creativity

581
00:21:31,990 --> 00:21:29,760
in many respects traditional tenure

582
00:21:34,470 --> 00:21:32,000
system does not promote and reward

583
00:21:37,110 --> 00:21:34,480
innovation it promotes and rewards

584
00:21:38,950 --> 00:21:37,120
people who follow a set set of criteria

585
00:21:40,789 --> 00:21:38,960
and at the major research universities

586
00:21:42,710 --> 00:21:40,799
we're breaking down those barriers so

587
00:21:44,470 --> 00:21:42,720
that people who are creative

588
00:21:45,990 --> 00:21:44,480

who think differently

589
00:21:49,669 --> 00:21:46,000
get rewarded

590
00:21:50,390 --> 00:21:49,679
and promoted we're also working closely

591
00:21:55,590 --> 00:21:50,400
to

592
00:21:58,789 --> 00:21:55,600
a triangle of university

593
00:21:59,669 --> 00:21:58,799
government and industry that is critical

594
00:22:02,070 --> 00:21:59,679
to the

595
00:22:03,909 --> 00:22:02,080
output component of what we do in terms

596
00:22:06,710 --> 00:22:03,919
of doing things that are

597
00:22:10,390 --> 00:22:06,720
good for society

598
00:22:12,630 --> 00:22:10,400
the united states has a unique ecosystem

599
00:22:15,750 --> 00:22:12,640
for for doing that in fact if you look

600
00:22:18,310 --> 00:22:15,760
at the rankings of world universities

601
00:22:20,549 --> 00:22:18,320
the united states populates almost all

602
00:22:23,990 --> 00:22:20,559
of the slots in the top 100 or so

603
00:22:25,990 --> 00:22:24,000
because of the unique way that we couple

604
00:22:28,549 --> 00:22:26,000
the education to research the service

605
00:22:30,950 --> 00:22:28,559
and also government and university and

606
00:22:32,950 --> 00:22:30,960
industry activities and that is very

607
00:22:35,830 --> 00:22:32,960
important and we should not

608
00:22:36,789 --> 00:22:35,840
neglect that as we uh go forward

609
00:22:38,310 --> 00:22:36,799
people

610
00:22:39,750 --> 00:22:38,320
always ask me know that i'm the vice

611
00:22:41,430 --> 00:22:39,760
president for research well what's

612
00:22:43,270 --> 00:22:41,440
what's the next big thing you know

613
00:22:44,870 --> 00:22:43,280

what's the really coming technology we

614
00:22:46,789 --> 00:22:44,880
should focus on

615
00:22:48,870 --> 00:22:46,799
and you know i used to give an answer

616
00:22:51,190 --> 00:22:48,880
like nanobiotechnology but it occurred

617
00:22:54,310 --> 00:22:51,200
to me that the actual answer has not

618
00:22:56,230 --> 00:22:54,320
really changed for thousands of years

619
00:22:58,549 --> 00:22:56,240
what's important are two things there's

620
00:23:00,310 --> 00:22:58,559
a metaphysical connection question of

621
00:23:02,630 --> 00:23:00,320
where we are in the universe and to

622
00:23:05,110 --> 00:23:02,640
explain uh the universe about us and

623
00:23:07,430 --> 00:23:05,120
it's also the physical world and what

624
00:23:09,909 --> 00:23:07,440
really people care about in terms of

625
00:23:11,590 --> 00:23:09,919
research is how it impacts a very small

626
00:23:12,549 --> 00:23:11,600
number of things

627
00:23:13,750 --> 00:23:12,559
water

628
00:23:14,710 --> 00:23:13,760
healthcare

629
00:23:15,909 --> 00:23:14,720
energy

630
00:23:17,029 --> 00:23:15,919
environment

631
00:23:18,310 --> 00:23:17,039
food

632
00:23:19,590 --> 00:23:18,320
information

633
00:23:21,190 --> 00:23:19,600
infrastructure

634
00:23:24,870 --> 00:23:21,200
transportation

635
00:23:27,430 --> 00:23:24,880
and security so all technologies

636
00:23:30,230 --> 00:23:27,440
that we work on are only important if

637
00:23:31,029 --> 00:23:30,240
they actually produce output

638
00:23:33,190 --> 00:23:31,039

which

639
00:23:34,470 --> 00:23:33,200
impacts one of those things that i just

640
00:23:36,630 --> 00:23:34,480
mentioned so

641
00:23:39,350 --> 00:23:36,640
at the university of maryland we are

642
00:23:42,310 --> 00:23:39,360
very much focused on these important

643
00:23:44,310 --> 00:23:42,320
fundamentals in connecting education

644
00:23:46,549 --> 00:23:44,320
research and service

645
00:23:47,510 --> 00:23:46,559
and we have had a strong record of

646
00:23:50,549 --> 00:23:47,520
training

647
00:23:52,470 --> 00:23:50,559
nasa astronauts in fact two of our

648
00:23:53,510 --> 00:23:52,480
graduates gave their lives for nasa and

649
00:23:55,430 --> 00:23:53,520
their country

650
00:23:57,510 --> 00:23:55,440
william mccool

651
00:24:00,230 --> 00:23:57,520
computer science graduate was the pilot

652
00:24:01,269 --> 00:24:00,240
of the columbia space shuttle and judith

653
00:24:03,909 --> 00:24:01,279
resnick

654
00:24:05,269 --> 00:24:03,919
was a missile specialist on challenger

655
00:24:07,430 --> 00:24:05,279
so

656
00:24:08,630 --> 00:24:07,440
our students have

657
00:24:10,630 --> 00:24:08,640
really done a great job for their

658
00:24:13,909 --> 00:24:10,640
country and represented their university

659
00:24:18,549 --> 00:24:13,919
very well so thank you very much

660
00:24:23,190 --> 00:24:20,870
so as our next speaker we have dr david

661
00:24:25,669 --> 00:24:23,200
barb who's executive director of the

662
00:24:27,190 --> 00:24:25,679
maryland technology enterprise institute

663
00:24:29,269 --> 00:24:27,200

and david has a varied background

664
00:24:32,310 --> 00:24:29,279
starting in industry in what what

665
00:24:34,549 --> 00:24:32,320
westinghouse up the road at bw parkway

666
00:24:36,390 --> 00:24:34,559
he worked at the nrl the naval research

667
00:24:38,950 --> 00:24:36,400
lab also at the office of secretary of

668
00:24:40,549 --> 00:24:38,960
the navy before he joined the university

669
00:24:41,909 --> 00:24:40,559
of maryland

670
00:24:43,750 --> 00:24:41,919
the thing that he seemed to be most

671
00:24:47,750 --> 00:24:43,760
proud of when i spoke to him is the fact

672
00:24:50,070 --> 00:24:47,760
that he wrote a invited paper for ieee a

673
00:24:51,990 --> 00:24:50,080
number of years ago on a technology that

674
00:24:54,390 --> 00:24:52,000
can be found everywhere and i mean

675
00:24:56,070 --> 00:24:54,400
everywhere in fact in this room there

676
00:24:58,230 --> 00:24:56,080
just about every one of us has a cell

677
00:25:01,909 --> 00:24:58,240
phone or an ipad or a computer with

678
00:25:03,669 --> 00:25:01,919
these ccds david helped write a paper

679
00:25:06,310 --> 00:25:03,679
that was considered by many that were

680
00:25:09,110 --> 00:25:06,320
starting up in the industry decades ago

681
00:25:11,190 --> 00:25:09,120
on ccds as the founding paper almost the

682
00:25:12,710 --> 00:25:11,200
bible as ccds

683
00:25:14,950 --> 00:25:12,720
now david is going to be talking about

684
00:25:17,190 --> 00:25:14,960
what novel techniques he uses to help

685
00:25:19,990 --> 00:25:17,200
foster innovation or help inspire more

686
00:25:22,789 --> 00:25:20,000
innovation in entrepreneurs

687
00:25:25,190 --> 00:25:22,799
thank you and good morning

688
00:25:26,149 --> 00:25:25,200

so i think we can pretty much all agree

689
00:25:27,909 --> 00:25:26,159
that

690
00:25:30,070 --> 00:25:27,919
there's a great amount of technology

691
00:25:31,669 --> 00:25:30,080
that's being developed in university

692
00:25:33,269 --> 00:25:31,679
research labs and in governmental

693
00:25:35,269 --> 00:25:33,279
research labs

694
00:25:37,190 --> 00:25:35,279
but not enough of it is getting into

695
00:25:39,909 --> 00:25:37,200
products and services for the benefit of

696
00:25:44,710 --> 00:25:42,070
from my perspective i think there's some

697
00:25:46,950 --> 00:25:44,720
basic elements of a formula

698
00:25:49,190 --> 00:25:46,960
for innovation and those elements would

699
00:25:50,630 --> 00:25:49,200
be the following

700
00:25:52,950 --> 00:25:50,640
first of all

701
00:25:55,430 --> 00:25:52,960
emphasize entrepreneurship in

702
00:25:58,870 --> 00:25:55,440
engineering and science schools

703
00:26:00,870 --> 00:25:58,880
and also in government research labs

704
00:26:01,830 --> 00:26:00,880
from a university point of view i think

705
00:26:06,549 --> 00:26:01,840
the

706
00:26:08,870 --> 00:26:06,559
broadened from research and education

707
00:26:11,510 --> 00:26:08,880
to research education entrepreneurship

708
00:26:13,830 --> 00:26:11,520
and innovation

709
00:26:18,390 --> 00:26:13,840
we need more technologists to understand

710
00:26:22,630 --> 00:26:20,390
secondly i think we need to introduce

711
00:26:25,750 --> 00:26:22,640
entrepreneurship to students at a very

712
00:26:28,230 --> 00:26:25,760
early age based on our experience at the

713
00:26:30,470 --> 00:26:28,240

university of maryland we know it works

714
00:26:33,830 --> 00:26:30,480
down to eighth graders

715
00:26:37,190 --> 00:26:33,840
and i think that it can even work at an

716
00:26:39,510 --> 00:26:37,200
earlier age so we need to develop a

717
00:26:43,430 --> 00:26:39,520
cadre of students

718
00:26:44,390 --> 00:26:43,440
who will become successful entrepreneurs

719
00:26:45,909 --> 00:26:44,400
and

720
00:26:47,590 --> 00:26:45,919
i might say maybe with a little

721
00:26:49,590 --> 00:26:47,600
exaggeration i think it's never too

722
00:26:52,149 --> 00:26:49,600
early to start

723
00:26:53,510 --> 00:26:52,159
educating students young students about

724
00:26:56,230 --> 00:26:53,520
entrepreneurship

725
00:26:58,310 --> 00:26:56,240
and i was very happy to see the the the

726
00:27:01,029 --> 00:26:58,320
hands-on

727
00:27:04,070 --> 00:27:01,039
demonstration in the nasa video because

728
00:27:06,149 --> 00:27:04,080
i think the way to to introduce students

729
00:27:07,909 --> 00:27:06,159
to entrepreneurship is through hands-on

730
00:27:11,350 --> 00:27:07,919
experiential

731
00:27:13,430 --> 00:27:11,360
processes rather than theory

732
00:27:15,830 --> 00:27:13,440
i think the third thing we need to do is

733
00:27:17,269 --> 00:27:15,840
to develop a continuum of programs and

734
00:27:19,430 --> 00:27:17,279
activities

735
00:27:20,470 --> 00:27:19,440
to develop support to develop and

736
00:27:22,789 --> 00:27:20,480
support

737
00:27:25,430 --> 00:27:22,799
technology-based startups

738
00:27:27,990 --> 00:27:25,440

from our research labs

739
00:27:30,630 --> 00:27:28,000
we need to identify

740
00:27:33,110 --> 00:27:30,640
opportunities we identify problems that

741
00:27:37,669 --> 00:27:33,120
turn into opportunities in our research

742
00:27:41,830 --> 00:27:37,679
labs we need to create an intensive uh

743
00:27:43,830 --> 00:27:41,840
short-term support for those startups

744
00:27:45,350 --> 00:27:43,840
sometimes people call that an

745
00:27:47,909 --> 00:27:45,360
accelerator

746
00:27:49,990 --> 00:27:47,919
and we need a longer term incubation and

747
00:27:51,669 --> 00:27:50,000
mentoring process because you really

748
00:27:53,909 --> 00:27:51,679
need to stick with these startup

749
00:27:57,029 --> 00:27:53,919
companies for some period of time in

750
00:27:58,389 --> 00:27:57,039
order for them to be successful

751
00:28:00,310 --> 00:27:58,399
and finally

752
00:28:02,310 --> 00:28:00,320
it's very important that the support

753
00:28:07,110 --> 00:28:02,320
services be very near as near as

754
00:28:12,310 --> 00:28:09,110
fourth i need i think we need to create

755
00:28:14,470 --> 00:28:12,320
incentives to bring researchers who

756
00:28:17,430 --> 00:28:14,480
develop technologies

757
00:28:19,590 --> 00:28:17,440
and companies that want to pull the

758
00:28:21,029 --> 00:28:19,600
technologies out of these research labs

759
00:28:23,029 --> 00:28:21,039
together

760
00:28:27,269 --> 00:28:23,039
to create new and improved products and

761
00:28:32,789 --> 00:28:29,830
finally i think there are plenty of

762
00:28:34,870 --> 00:28:32,799
models for doing these things that have

763
00:28:36,310 --> 00:28:34,880

proven to work and had

764
00:28:38,149 --> 00:28:36,320
really excellent

765
00:28:39,830 --> 00:28:38,159
results

766
00:28:41,669 --> 00:28:39,840
and i think rather than waiting for

767
00:28:43,669 --> 00:28:41,679
somebody to

768
00:28:44,950 --> 00:28:43,679
develop a silver bullet

769
00:28:47,190 --> 00:28:44,960
i think that's what we're doing we're

770
00:28:49,029 --> 00:28:47,200
kind of waiting for somebody to

771
00:28:50,230 --> 00:28:49,039
have a silver bullet for innovation i

772
00:28:52,149 --> 00:28:50,240
think

773
00:28:55,110 --> 00:28:52,159
the basic

774
00:28:57,669 --> 00:28:55,120
processes of doing innovation that i've

775
00:29:00,549 --> 00:28:57,679
mentioned before exist it's a matter of

776
00:29:02,389 --> 00:29:00,559
adapting and adopting them to your own

777
00:29:03,909 --> 00:29:02,399
processes

778
00:29:06,630 --> 00:29:03,919
so

779
00:29:10,070 --> 00:29:06,640
my closing words would be to i think we

780
00:29:14,710 --> 00:29:10,080
need to follow the nike slogan

781
00:29:14,720 --> 00:29:19,669
great

782
00:29:24,070 --> 00:29:20,950
thank you david

783
00:29:26,789 --> 00:29:24,080
and rounding out our panel we have our

784
00:29:29,110 --> 00:29:26,799
our token scientists but not just any

785
00:29:31,269 --> 00:29:29,120
token scientist um the

786
00:29:33,830 --> 00:29:31,279
the title that was provided to us about

787
00:29:35,590 --> 00:29:33,840
dr ralph mcnutt that he's a physicist a

788
00:29:36,870 --> 00:29:35,600

member of the principal professional

789
00:29:38,789 --> 00:29:36,880
staff at

790
00:29:40,789 --> 00:29:38,799
johns hopkins university's applied

791
00:29:42,950 --> 00:29:40,799
physics laboratory but i don't think

792
00:29:44,950 --> 00:29:42,960
that is deserving enough what's more

793
00:29:46,549 --> 00:29:44,960
important i think he's a

794
00:29:48,549 --> 00:29:46,559
project scientist for

795
00:29:51,350 --> 00:29:48,559
for a number of really critical missions

796
00:29:54,230 --> 00:29:51,360
for nasa including messenger that's at

797
00:29:55,190 --> 00:29:54,240
mercury right now or flying by just flew

798
00:29:57,669 --> 00:29:55,200
by

799
00:29:59,750 --> 00:29:57,679
but he's also explored all areas of our

800
00:30:01,830 --> 00:29:59,760
solar system he's had

801
00:30:04,710 --> 00:30:01,840
his hands on as a co-eye for the new

802
00:30:06,789 --> 00:30:04,720
horizons mission voyager and cassini so

803
00:30:08,950 --> 00:30:06,799
he's really explored from edge to edge

804
00:30:10,630 --> 00:30:08,960
of our solar system when i was asking

805
00:30:12,230 --> 00:30:10,640
him about some most noteworthy

806
00:30:15,830 --> 00:30:12,240
accomplishments or things he's involved

807
00:30:17,990 --> 00:30:15,840
in um he sent me a whole slew of mpeg

808
00:30:20,149 --> 00:30:18,000
files and all kinds of

809
00:30:21,909 --> 00:30:20,159
documents he's generated was absolutely

810
00:30:23,350 --> 00:30:21,919
impressive the one thing that really

811
00:30:25,830 --> 00:30:23,360
struck me is trying to reach out to

812
00:30:27,350 --> 00:30:25,840
school students to help define a whole

813
00:30:29,510 --> 00:30:27,360

new mission called the innovative

814
00:30:31,269 --> 00:30:29,520
interstellar explorer where we want to

815
00:30:33,110 --> 00:30:31,279
go explore you know have a mission

816
00:30:35,350 --> 00:30:33,120
concept to explore the interstellar

817
00:30:37,430 --> 00:30:35,360
space beyond our solar system and with

818
00:30:39,590 --> 00:30:37,440
that he's trying to see the imagination

819
00:30:42,230 --> 00:30:39,600
and creativity and inspire youth to

820
00:30:44,870 --> 00:30:42,240
engage in this this exploration

821
00:30:46,549 --> 00:30:44,880
endeavor that we're undertaking

822
00:30:49,029 --> 00:30:46,559
today he's going to talk about the

823
00:30:51,350 --> 00:30:49,039
importance of of innovation for

824
00:30:52,389 --> 00:30:51,360
enabling science missions and scientific

825
00:30:54,149 --> 00:30:52,399
research

826
00:30:55,990 --> 00:30:54,159
thanks peter well it's a pleasure to be

827
00:30:57,669 --> 00:30:56,000
here and to be able to have this

828
00:30:59,830 --> 00:30:57,679
audience and to talk a little bit with

829
00:31:03,269 --> 00:30:59,840
you about what we're doing with

830
00:31:05,269 --> 00:31:03,279
innovation in and technology in the part

831
00:31:07,430 --> 00:31:05,279
of the science missions that nasa

832
00:31:09,509 --> 00:31:07,440
carries out

833
00:31:10,310 --> 00:31:09,519
certainly if it weren't for the fact

834
00:31:11,110 --> 00:31:10,320
that

835
00:31:14,310 --> 00:31:11,120
we

836
00:31:16,230 --> 00:31:14,320
have technology and a lot of innovation

837
00:31:17,909 --> 00:31:16,240
most of these missions that we've been

838
00:31:20,149 --> 00:31:17,919

running around the solar system with

839
00:31:22,149 --> 00:31:20,159
simply would not exist because when

840
00:31:24,070 --> 00:31:22,159
you're when you're actually sending out

841
00:31:25,350 --> 00:31:24,080
sending out spacecraft to try to make

842
00:31:27,830 --> 00:31:25,360
measurements

843
00:31:29,269 --> 00:31:27,840
that no one's made before and sometimes

844
00:31:31,430 --> 00:31:29,279
learning things that you didn't even

845
00:31:33,350 --> 00:31:31,440
know to ask the questions about it

846
00:31:34,870 --> 00:31:33,360
really is a question of where the rubber

847
00:31:37,750 --> 00:31:34,880
hits the road

848
00:31:39,590 --> 00:31:37,760
you have to somehow worry about not only

849
00:31:41,909 --> 00:31:39,600
what sort of science questions you want

850
00:31:43,269 --> 00:31:41,919
to answer and address

851
00:31:45,990 --> 00:31:43,279
but what kind of measurements you need

852
00:31:48,630 --> 00:31:46,000
to make how do i turn that into hardware

853
00:31:50,389 --> 00:31:48,640
and then perhaps most importantly how in

854
00:31:52,149 --> 00:31:50,399
the world do i package that within the

855
00:31:54,710 --> 00:31:52,159
mass and the power and the available

856
00:31:56,789 --> 00:31:54,720
launch vehicles and oh yes the money

857
00:31:58,710 --> 00:31:56,799
that is available for actually carrying

858
00:32:00,710 --> 00:31:58,720
these missions out

859
00:32:03,990 --> 00:32:00,720
one of the things that nasa does

860
00:32:05,990 --> 00:32:04,000
incredibly well is to promote innovation

861
00:32:08,230 --> 00:32:06,000
through competition uh there's the

862
00:32:10,950 --> 00:32:08,240
discovery in the new frontiers and

863
00:32:12,710 --> 00:32:10,960

explorer lines of com competed missions

864
00:32:14,549 --> 00:32:12,720
that nasa has

865
00:32:18,470 --> 00:32:14,559
science teams can go out and actually

866
00:32:20,310 --> 00:32:18,480
compete uh the best idea wins and uh

867
00:32:23,509 --> 00:32:20,320
you've got a chance to actually go prove

868
00:32:25,909 --> 00:32:23,519
that you can go out and uh and do some

869
00:32:28,230 --> 00:32:25,919
exploring of the cosmos i should say

870
00:32:30,630 --> 00:32:28,240
that i got involved with all of this uh

871
00:32:32,950 --> 00:32:30,640
back when i was nine years old watching

872
00:32:36,070 --> 00:32:32,960
gus grissom go up on the second

873
00:32:37,990 --> 00:32:36,080
suborbital flight and then

874
00:32:39,830 --> 00:32:38,000
i guess it was in 62 of course john

875
00:32:41,590 --> 00:32:39,840
glenn made his orbital trip around the

876
00:32:44,310 --> 00:32:41,600
earth that was also the year that

877
00:32:47,509 --> 00:32:44,320
mariner 2 that was the first successful

878
00:32:50,149 --> 00:32:47,519
u.s interplanetary mission flew by venus

879
00:32:52,070 --> 00:32:50,159
and i've still got that that article

880
00:32:54,470 --> 00:32:52,080
from the newspaper and my scrapbook at

881
00:32:55,830 --> 00:32:54,480
home and i was hooked

882
00:32:57,909 --> 00:32:55,840
it was a

883
00:32:59,590 --> 00:32:57,919
real pleasure to be able to get involved

884
00:33:02,630 --> 00:32:59,600
with the voyager project when i was a

885
00:33:04,789 --> 00:33:02,640
graduate student i actually was able to

886
00:33:07,990 --> 00:33:04,799
go out with some of the engineers to do

887
00:33:10,070 --> 00:33:08,000
vibration testing on that out at jpl

888
00:33:12,549 --> 00:33:10,080

with one of the units that's on voyager

889
00:33:15,590 --> 00:33:12,559
1 which is now 10 billion miles from

890
00:33:16,870 --> 00:33:15,600
earth that's a little more than 12 light

891
00:33:19,269 --> 00:33:16,880
hours out

892
00:33:21,350 --> 00:33:19,279
and of course voyager which was launched

893
00:33:24,389 --> 00:33:21,360
almost the two voyagers launched almost

894
00:33:26,789 --> 00:33:24,399
34 years ago

895
00:33:28,710 --> 00:33:26,799
will be by the end of this month

896
00:33:30,470 --> 00:33:28,720
they're still working and of course this

897
00:33:31,830 --> 00:33:30,480
is you know this gets a little bit back

898
00:33:33,590 --> 00:33:31,840
to some of the things we were saying

899
00:33:35,590 --> 00:33:33,600
earlier about

900
00:33:38,789 --> 00:33:35,600
one of the issues that i think nasa has

901
00:33:40,950 --> 00:33:38,799
is to try to figure out how to reach out

902
00:33:42,789 --> 00:33:40,960
and tell more people about what's going

903
00:33:44,549 --> 00:33:42,799
on i mean this is you know talk about

904
00:33:46,950 --> 00:33:44,559
innovative technology originally when

905
00:33:49,509 --> 00:33:46,960
the grand tour was dreamed up

906
00:33:52,710 --> 00:33:49,519
by a graduate student named gary flandro

907
00:33:54,549 --> 00:33:52,720
back in the mid 60s the real problem was

908
00:33:56,630 --> 00:33:54,559
figuring out how in the world that you

909
00:33:57,590 --> 00:33:56,640
could make a spacecraft last for 12

910
00:33:59,990 --> 00:33:57,600
years

911
00:34:03,430 --> 00:34:00,000
and the original concept for the grand

912
00:34:07,669 --> 00:34:05,590
was cancelled and everybody was told to

913
00:34:09,349 --> 00:34:07,679

go back to the drawing board

914
00:34:11,109 --> 00:34:09,359
to come up with a modest mission that

915
00:34:13,349 --> 00:34:11,119
would only ha only had the requirement

916
00:34:14,950 --> 00:34:13,359
of lasting for five years and that's

917
00:34:17,750 --> 00:34:14,960
what turned into the voyagers and of

918
00:34:19,909 --> 00:34:17,760
course the spectacular success uh gave

919
00:34:21,589 --> 00:34:19,919
us our first clear view of the outer

920
00:34:22,470 --> 00:34:21,599
part of the solar system

921
00:34:24,069 --> 00:34:22,480
but

922
00:34:26,790 --> 00:34:24,079
some of the instruments on board are

923
00:34:28,869 --> 00:34:26,800
still working and uh every week they're

924
00:34:30,869 --> 00:34:28,879
sending back data on how that the how

925
00:34:32,629 --> 00:34:30,879
that the outer part of the solar wind

926
00:34:34,470 --> 00:34:32,639
actually interacts with the interstellar

927
00:34:36,470 --> 00:34:34,480
medium and the mission that peter was

928
00:34:38,230 --> 00:34:36,480
referring to that i've been pushing on

929
00:34:40,389 --> 00:34:38,240
would be the one that would take over to

930
00:34:43,109 --> 00:34:40,399
take over from that one

931
00:34:45,109 --> 00:34:43,119
in terms of innovation um

932
00:34:46,790 --> 00:34:45,119
again when did you go to some place you

933
00:34:48,550 --> 00:34:46,800
haven't been before you really have to

934
00:34:50,790 --> 00:34:48,560
think things through and that's one of

935
00:34:53,190 --> 00:34:50,800
the reasons that you need the best of

936
00:34:55,270 --> 00:34:53,200
the brightest to be in this business

937
00:34:57,829 --> 00:34:55,280
messenger was mission was mentioned we

938
00:35:00,069 --> 00:34:57,839

launched back in 2004 it was actually

939
00:35:02,550 --> 00:35:00,079
originally conceived as a discovery

940
00:35:04,790 --> 00:35:02,560
proposal back in 1996 we went through

941
00:35:07,270 --> 00:35:04,800
the proposal process twice

942
00:35:10,230 --> 00:35:07,280
approved for uh development back in 2000

943
00:35:12,950 --> 00:35:10,240
launched in 2004 and we've now been in

944
00:35:14,790 --> 00:35:12,960
orbit about mercury first time that a

945
00:35:17,109 --> 00:35:14,800
spacecraft has been in orbit about the

946
00:35:19,430 --> 00:35:17,119
innermost planet spacecraft built here

947
00:35:21,510 --> 00:35:19,440
in maryland by the way

948
00:35:23,829 --> 00:35:21,520
and we've taken over 40 000 photos of

949
00:35:25,510 --> 00:35:23,839
the planet we're putting together a map

950
00:35:26,950 --> 00:35:25,520
in terms of in terms of really

951
00:35:29,109 --> 00:35:26,960
innovative technologies one of the

952
00:35:31,109 --> 00:35:29,119
things that's on board messenger is a

953
00:35:34,150 --> 00:35:31,119
gamma-ray spectrometer which we are

954
00:35:36,790 --> 00:35:34,160
using to understand for the first time

955
00:35:38,630 --> 00:35:36,800
what mercury is really made out of and

956
00:35:41,030 --> 00:35:38,640
we've already made some rather

957
00:35:43,109 --> 00:35:41,040
interesting discoveries about how that

958
00:35:44,550 --> 00:35:43,119
mercury is very definitely not like the

959
00:35:46,950 --> 00:35:44,560
moon and much more like the other

960
00:35:48,950 --> 00:35:46,960
terrestrial planets in the solar system

961
00:35:51,190 --> 00:35:48,960
the only way we were able to make that

962
00:35:55,270 --> 00:35:51,200
work was in order to

963
00:35:57,510 --> 00:35:55,280

have a cryogenically cooled detector so

964
00:35:59,829 --> 00:35:57,520
there's actually a there's actually a

965
00:36:01,430 --> 00:35:59,839
cryo cooler that is about the size of a

966
00:36:03,190 --> 00:36:01,440
coca-cola can

967
00:36:05,030 --> 00:36:03,200
which is currently running on this

968
00:36:06,870 --> 00:36:05,040
mission in orbit around the hottest

969
00:36:08,870 --> 00:36:06,880
planet in the solar system

970
00:36:10,870 --> 00:36:08,880
and driving the detector temperature

971
00:36:13,030 --> 00:36:10,880
down to 90 degrees kelvin 90 degrees

972
00:36:16,230 --> 00:36:13,040
above absolute zero and that's what

973
00:36:18,150 --> 00:36:16,240
makes it work there is no backup when we

974
00:36:21,190 --> 00:36:18,160
originally were putting this together

975
00:36:22,870 --> 00:36:21,200
there was very limited uh flight

976
00:36:24,950 --> 00:36:22,880
information on what you could do with

977
00:36:26,550 --> 00:36:24,960
these this is a this was a cooler that

978
00:36:28,230 --> 00:36:26,560
was originally developed

979
00:36:29,750 --> 00:36:28,240
for flying on

980
00:36:31,349 --> 00:36:29,760
air-to-air missiles

981
00:36:33,990 --> 00:36:31,359
didn't have to work for that long in

982
00:36:36,230 --> 00:36:34,000
that particular application

983
00:36:38,230 --> 00:36:36,240
as far as anybody knew the mean lifetime

984
00:36:40,150 --> 00:36:38,240
for it to function was something like

985
00:36:41,270 --> 00:36:40,160
one year plus or minus one and a half

986
00:36:44,150 --> 00:36:41,280
years

987
00:36:45,829 --> 00:36:44,160
and uh so you know talk talk about

988
00:36:48,230 --> 00:36:45,839

innovative we we ended up actually

989
00:36:50,470 --> 00:36:48,240
getting involved not only with uh

990
00:36:51,990 --> 00:36:50,480
not only with the the makers of that

991
00:36:53,510 --> 00:36:52,000
that particular cooler came out of

992
00:36:55,430 --> 00:36:53,520
israel

993
00:36:57,270 --> 00:36:55,440
but also we had colleagues at the

994
00:36:58,950 --> 00:36:57,280
department of energy at lawrence

995
00:37:01,190 --> 00:36:58,960
lawrence berkeley national lab and

996
00:37:03,750 --> 00:37:01,200
lawrence livermore national laboratory

997
00:37:05,829 --> 00:37:03,760
who aided us in order to put the whole

998
00:37:06,710 --> 00:37:05,839
package together with the thermal design

999
00:37:09,190 --> 00:37:06,720
and

1000
00:37:11,430 --> 00:37:09,200
that being able to do that with that

1001
00:37:13,349 --> 00:37:11,440
sort of innovation on the fly

1002
00:37:15,349 --> 00:37:13,359
has actually opened up a whole new

1003
00:37:17,109 --> 00:37:15,359
chapter in what we're learning and what

1004
00:37:19,030 --> 00:37:17,119
we're understanding about the inner part

1005
00:37:21,030 --> 00:37:19,040
of the solar system and let me just

1006
00:37:22,390 --> 00:37:21,040
close with with one more example one of

1007
00:37:25,270 --> 00:37:22,400
the things that's currently under

1008
00:37:27,430 --> 00:37:25,280
development uh is a new a new probe a

1009
00:37:28,950 --> 00:37:27,440
thing called solar probe plus it's just

1010
00:37:30,630 --> 00:37:28,960
in the it's just in the beginning and if

1011
00:37:32,150 --> 00:37:30,640
you thought if you thought messenger was

1012
00:37:33,109 --> 00:37:32,160
hard and i've told this to the engineers

1013
00:37:35,030 --> 00:37:33,119

before

1014
00:37:37,510 --> 00:37:35,040
uh this one gets even more interesting

1015
00:37:40,470 --> 00:37:37,520
we had uh we've of course known about

1016
00:37:43,190 --> 00:37:40,480
the solar wind that uh is the medium by

1017
00:37:44,790 --> 00:37:43,200
which that the uh the sun affects uh

1018
00:37:46,710 --> 00:37:44,800
lots of things that go along in our

1019
00:37:49,430 --> 00:37:46,720
technological society on the on the

1020
00:37:52,150 --> 00:37:49,440
surface of the earth from uh blackberry

1021
00:37:53,750 --> 00:37:52,160
uh reception uh all the way to

1022
00:37:56,230 --> 00:37:53,760
satellites working

1023
00:37:58,069 --> 00:37:56,240
and um we first discovered that the

1024
00:38:00,390 --> 00:37:58,079
solar wind really did exist with the

1025
00:38:02,390 --> 00:38:00,400
mariner 2 measurements back in 62 had

1026
00:38:04,550 --> 00:38:02,400
been predicted theoretically by gene

1027
00:38:07,030 --> 00:38:04,560
parker physicist at university of

1028
00:38:09,270 --> 00:38:07,040
chicago back in the late 50s but the

1029
00:38:12,630 --> 00:38:09,280
problem is we still don't understand the

1030
00:38:14,870 --> 00:38:12,640
physics of how exactly that the sun

1031
00:38:17,109 --> 00:38:14,880
makes the solar wind and why that the

1032
00:38:19,349 --> 00:38:17,119
corona is so hot so for the last 50

1033
00:38:21,109 --> 00:38:19,359
years uh the scientific community has

1034
00:38:22,950 --> 00:38:21,119
wanted to try to send a probe into the

1035
00:38:24,710 --> 00:38:22,960
outer atmosphere of the sun

1036
00:38:26,870 --> 00:38:24,720
and uh one of the things that the

1037
00:38:29,430 --> 00:38:26,880
science mission directorate uh

1038
00:38:31,430 --> 00:38:29,440

has uh has got going right now are the

1039
00:38:32,630 --> 00:38:31,440
are studies for actually building that

1040
00:38:34,069 --> 00:38:32,640
spacecraft

1041
00:38:36,470 --> 00:38:34,079
and there's been a selection of

1042
00:38:39,030 --> 00:38:36,480
instruments and hopefully uh hopefully

1043
00:38:41,270 --> 00:38:39,040
things will will carry on we're hoping

1044
00:38:43,430 --> 00:38:41,280
for a launch in 2018 with a mission

1045
00:38:45,190 --> 00:38:43,440
running until 2026

1046
00:38:47,270 --> 00:38:45,200
and it gets back to getting a lot of

1047
00:38:48,710 --> 00:38:47,280
people out there that

1048
00:38:50,790 --> 00:38:48,720
might think that they're interested in

1049
00:38:53,109 --> 00:38:50,800
science to go ahead and

1050
00:38:55,030 --> 00:38:53,119
start working on start working on honing

1051
00:38:56,950 --> 00:38:55,040
your math skills and your english skills

1052
00:38:59,430 --> 00:38:56,960
because we're going to be needing you to

1053
00:39:01,190 --> 00:38:59,440
help to analyze that data and perhaps a

1054
00:39:04,870 --> 00:39:01,200
little later with

1055
00:39:07,670 --> 00:39:04,880
some data from the interstellar explorer

1056
00:39:12,310 --> 00:39:07,680
back to you thank you ryan

1057
00:39:15,829 --> 00:39:14,230
thank you to our panel we'll now take

1058
00:39:18,950 --> 00:39:15,839
questions from here in the audience and

1059
00:39:20,470 --> 00:39:18,960
also from our followers on twitter

1060
00:39:21,589 --> 00:39:20,480
if you have questions for the panelists

1061
00:39:23,750 --> 00:39:21,599
and you're

1062
00:39:27,109 --> 00:39:23,760
following us on twitter please send them

1063
00:39:28,710 --> 00:39:27,119

to our at nasa underscore technology

1064
00:39:29,910 --> 00:39:28,720
twitter account and we'll try and get

1065
00:39:31,109 --> 00:39:29,920
them up here to the panel and if you

1066
00:39:32,470 --> 00:39:31,119
have questions here in the audience

1067
00:39:33,829 --> 00:39:32,480
please come up to the microphones

1068
00:39:35,910 --> 00:39:33,839
they're in the aisle

1069
00:39:39,030 --> 00:39:35,920
so that we can hear your questions and

1070
00:39:41,510 --> 00:39:39,040
our viewers on nasa tv can hear them

1071
00:39:42,710 --> 00:39:41,520
sir hi joe rivera the chief technology

1072
00:39:44,630 --> 00:39:42,720
officer for advocates technology i

1073
00:39:46,310 --> 00:39:44,640
wanted to expand a little bit on some of

1074
00:39:49,430 --> 00:39:46,320
the stuff that jennifer was saying and

1075
00:39:51,910 --> 00:39:49,440
and also uh dr barbie in that you know a

1076
00:39:53,990 --> 00:39:51,920
lot of times as a fellow academic we we

1077
00:39:55,750 --> 00:39:54,000
tend to focus on the on the you know

1078
00:39:57,589 --> 00:39:55,760
getting getting the phd getting the

1079
00:40:00,230 --> 00:39:57,599
masters getting the vasculars but we

1080
00:40:02,230 --> 00:40:00,240
tend to forget that real creativity and

1081
00:40:04,950 --> 00:40:02,240
real innovation is born of pain it's

1082
00:40:07,430 --> 00:40:04,960
born of rejection it's it's born to be

1083
00:40:08,550 --> 00:40:07,440
rejection by peers rejection of the norm

1084
00:40:12,150 --> 00:40:08,560
you know look at

1085
00:40:14,470 --> 00:40:12,160
michael dell uh bill gates michelangelo

1086
00:40:16,309 --> 00:40:14,480
lady gaga you know if you read anything

1087
00:40:17,510 --> 00:40:16,319
about their personal history you realize

1088
00:40:18,710 --> 00:40:17,520

that they were creative innovative

1089
00:40:22,150 --> 00:40:18,720
because they were rejected they were

1090
00:40:23,910 --> 00:40:22,160
felt pain we need to tap that market get

1091
00:40:25,349 --> 00:40:23,920
into those folks that say hey look we

1092
00:40:27,109 --> 00:40:25,359
realize you may not be the sharpest

1093
00:40:28,630 --> 00:40:27,119
crayon in the drawer but

1094
00:40:31,349 --> 00:40:28,640
you know we know that you have some pain

1095
00:40:33,589 --> 00:40:31,359
let's tap into that creativity by not

1096
00:40:35,030 --> 00:40:33,599
rejecting a little form of diversity not

1097
00:40:37,750 --> 00:40:35,040
you know not just focusing on the

1098
00:40:39,349 --> 00:40:37,760
academics but focusing on those people

1099
00:40:41,030 --> 00:40:39,359
that and trying to bring out that

1100
00:40:42,710 --> 00:40:41,040
creativity saying just because you feel

1101
00:40:44,710 --> 00:40:42,720
like you're being rejected just be

1102
00:40:47,349 --> 00:40:44,720
because you feel like you have pain

1103
00:40:49,349 --> 00:40:47,359
use that to propel yourself

1104
00:40:50,550 --> 00:40:49,359
to to find that creativity to find that

1105
00:40:51,910 --> 00:40:50,560
innovation

1106
00:40:53,829 --> 00:40:51,920
just a different market we need to tap

1107
00:40:55,589 --> 00:40:53,839
into

1108
00:40:57,349 --> 00:40:55,599
comments panel

1109
00:40:59,270 --> 00:40:57,359
well i'll say that

1110
00:41:01,349 --> 00:40:59,280
that's very

1111
00:41:03,109 --> 00:41:01,359
difficult to do i think it's it's

1112
00:41:04,790 --> 00:41:03,119
something that we have to

1113
00:41:08,470 --> 00:41:04,800

take that challenge on

1114
00:41:11,349 --> 00:41:08,480
because if you think about uh einstein

1115
00:41:16,230 --> 00:41:11,359
right and the example of how

1116
00:41:19,510 --> 00:41:16,240
his his inability to to really um

1117
00:41:21,510 --> 00:41:19,520
grasp the concept of of of the temporal

1118
00:41:23,670 --> 00:41:21,520
nature of things

1119
00:41:26,710 --> 00:41:23,680
that that was a frustration right that

1120
00:41:29,510 --> 00:41:26,720
was not something easy and yet

1121
00:41:31,589 --> 00:41:29,520
look what um came out of it

1122
00:41:33,829 --> 00:41:31,599
as a leader you know with uh

1123
00:41:36,710 --> 00:41:33,839
70 000

1124
00:41:39,270 --> 00:41:36,720
roughly in the corporation

1125
00:41:42,230 --> 00:41:39,280
how do you make those people whose idea

1126
00:41:44,710 --> 00:41:42,240
it wasn't feel valued and feel that

1127
00:41:48,230 --> 00:41:44,720
their contribution

1128
00:41:51,990 --> 00:41:48,240
really led to this better result

1129
00:41:54,390 --> 00:41:52,000
and how do you how do you make that cr

1130
00:41:56,710 --> 00:41:54,400
reward creative failures those are the

1131
00:41:59,349 --> 00:41:56,720
kinds of things that we

1132
00:42:01,750 --> 00:41:59,359
that's kind of it's not a geek thing

1133
00:42:03,910 --> 00:42:01,760
right but as a leader

1134
00:42:05,990 --> 00:42:03,920
in a technical world those are the types

1135
00:42:08,710 --> 00:42:06,000
of things that are really what we need

1136
00:42:13,510 --> 00:42:08,720
to be focused on as well yet so yes like

1137
00:42:16,630 --> 00:42:13,520
gigabit com yes multiple aperture optics

1138
00:42:19,510 --> 00:42:16,640

lots of other technology but sometimes

1139
00:42:22,309 --> 00:42:19,520
we we've proven as a society that if we

1140
00:42:24,550 --> 00:42:22,319
if we look at technology and say i want

1141
00:42:26,950 --> 00:42:24,560
to improve the technology readiness

1142
00:42:29,030 --> 00:42:26,960
level of this technology we've proven

1143
00:42:30,550 --> 00:42:29,040
we're able to do that

1144
00:42:33,109 --> 00:42:30,560
to david's point

1145
00:42:35,910 --> 00:42:33,119
what we sometimes have not been able to

1146
00:42:38,069 --> 00:42:35,920
do is transition that technology into a

1147
00:42:40,550 --> 00:42:38,079
compelling um

1148
00:42:42,309 --> 00:42:40,560
application that changes

1149
00:42:44,870 --> 00:42:42,319
changes lives

1150
00:42:46,550 --> 00:42:44,880
as joe was talking about so i think it's

1151
00:42:49,670 --> 00:42:46,560
really an important subject i'm glad

1152
00:42:50,870 --> 00:42:49,680
that that we focused on it

1153
00:42:52,630 --> 00:42:50,880
i could just

1154
00:42:54,069 --> 00:42:52,640
mention one other thing i think that's

1155
00:42:56,309 --> 00:42:54,079
fascinating that

1156
00:42:59,109 --> 00:42:56,319
innovation stems from a fundamental

1157
00:43:01,109 --> 00:42:59,119
dissatisfaction with the status quo

1158
00:43:02,630 --> 00:43:01,119
and if you're if you're satisfied with

1159
00:43:04,950 --> 00:43:02,640
the status quo and everything is going

1160
00:43:07,030 --> 00:43:04,960
fine you're not interested in change

1161
00:43:08,470 --> 00:43:07,040
so the the greatest innovators are the

1162
00:43:11,190 --> 00:43:08,480
ones that are standing in the in the

1163
00:43:13,349 --> 00:43:11,200

back going i don't like that

1164
00:43:14,790 --> 00:43:13,359
i want i want something else

1165
00:43:16,550 --> 00:43:14,800
and we uh you know

1166
00:43:18,069 --> 00:43:16,560
part of society is everyone trying to

1167
00:43:20,550 --> 00:43:18,079
work together and sometimes it's the

1168
00:43:21,510 --> 00:43:20,560
person who's who's in the back throwing

1169
00:43:22,950 --> 00:43:21,520
rocks

1170
00:43:24,230 --> 00:43:22,960
who's who's the one who's really going

1171
00:43:27,670 --> 00:43:24,240
to change things for the better for the

1172
00:43:29,270 --> 00:43:27,680
rest of us who are inside the box so how

1173
00:43:31,430 --> 00:43:29,280
do we how do we make the most out of

1174
00:43:39,030 --> 00:43:31,440
that that creative

1175
00:43:44,150 --> 00:43:40,790
all right innovation just need you to

1176
00:43:47,910 --> 00:43:45,270
david did you

1177
00:43:50,309 --> 00:43:47,920
so a couple of comments uh

1178
00:43:54,470 --> 00:43:50,319
one of the most difficult things i find

1179
00:43:56,870 --> 00:43:54,480
in teaching entrepreneurship classes is

1180
00:43:59,829 --> 00:43:56,880
letting the students know that

1181
00:44:01,750 --> 00:43:59,839
entrepreneurship by its very nature

1182
00:44:03,829 --> 00:44:01,760
you have to learn how to manage risk

1183
00:44:06,150 --> 00:44:03,839
because

1184
00:44:08,069 --> 00:44:06,160
if you look at successful entrepreneurs

1185
00:44:10,230 --> 00:44:08,079
typically they've failed a time or two

1186
00:44:11,430 --> 00:44:10,240
before they succeed so they have to be

1187
00:44:12,790 --> 00:44:11,440
able to

1188
00:44:13,910 --> 00:44:12,800

if you're too risk-averse you're

1189
00:44:15,670 --> 00:44:13,920
probably not going to be a good

1190
00:44:18,710 --> 00:44:15,680
entrepreneur okay

1191
00:44:20,950 --> 00:44:18,720
and secondly what entrepreneurs do is

1192
00:44:22,550 --> 00:44:20,960
they seek prop they look for problems

1193
00:44:27,430 --> 00:44:22,560
because they know a problem equals an

1194
00:44:31,829 --> 00:44:29,270
i like to tell my students that it's

1195
00:44:34,230 --> 00:44:31,839
important that they experience failure

1196
00:44:36,390 --> 00:44:34,240
you know we tend to reward students for

1197
00:44:37,990 --> 00:44:36,400
unbroken success in fact we do the same

1198
00:44:41,030 --> 00:44:38,000
with faculty

1199
00:44:43,670 --> 00:44:41,040
but as somebody famous once said failure

1200
00:44:46,390 --> 00:44:43,680
is the fuel of success and somebody else

1201
00:44:49,190 --> 00:44:46,400
said that success is not the the

1202
00:44:51,270 --> 00:44:49,200
lack of failure

1203
00:44:54,150 --> 00:44:51,280
i tell the students there are

1204
00:44:55,670 --> 00:44:54,160
six phases there's frustration

1205
00:44:58,790 --> 00:44:55,680
fear of failure

1206
00:45:01,510 --> 00:44:58,800
actual failure followed by serendipity

1207
00:45:04,230 --> 00:45:01,520
surprise and success and that's what all

1208
00:45:05,430 --> 00:45:04,240
explorers go through right lack of

1209
00:45:07,589 --> 00:45:05,440
funding

1210
00:45:09,990 --> 00:45:07,599
underfunded project you set off you get

1211
00:45:11,670 --> 00:45:10,000
lost and then you find the bahamas when

1212
00:45:14,230 --> 00:45:11,680
you're looking for china and you make

1213
00:45:15,589 --> 00:45:14,240

success of that

1214
00:45:17,349 --> 00:45:15,599
we've got to encourage that in our

1215
00:45:18,550 --> 00:45:17,359
students and our faculty

1216
00:45:21,349 --> 00:45:18,560
i think it's very important i had a

1217
00:45:22,710 --> 00:45:21,359
student come see me who had a 4.0 and i

1218
00:45:24,150 --> 00:45:22,720
was about to give him a b and he thought

1219
00:45:26,150 --> 00:45:24,160
his life was over because he was going

1220
00:45:27,349 --> 00:45:26,160
to get a 3.95

1221
00:45:28,870 --> 00:45:27,359
i told him this would be the most

1222
00:45:30,950 --> 00:45:28,880
important thing in your life actually to

1223
00:45:37,910 --> 00:45:30,960
get a 3.95 you'd be a better person for

1224
00:45:41,270 --> 00:45:39,349
again if you have any questions please

1225
00:45:43,030 --> 00:45:41,280
come up to the microphones

1226
00:45:46,470 --> 00:45:43,040
our panel is available to take your

1227
00:45:52,870 --> 00:45:46,480
questions here or via twitter uh at the

1228
00:45:56,390 --> 00:45:55,270
i kind of have a comment um

1229
00:46:00,150 --> 00:45:56,400
this is to

1230
00:46:02,790 --> 00:46:00,160
to joe parish the uh

1231
00:46:05,349 --> 00:46:02,800
sbir str stgr program is a very

1232
00:46:08,230 --> 00:46:05,359
important uh program for nasa and other

1233
00:46:09,990 --> 00:46:08,240
government agencies to fund early stage

1234
00:46:11,910 --> 00:46:10,000
innovation

1235
00:46:14,790 --> 00:46:11,920
and when it's discussed a lot of times

1236
00:46:16,309 --> 00:46:14,800
it's talked about in terms of sbir

1237
00:46:20,150 --> 00:46:16,319
but there's the university component

1238
00:46:22,230 --> 00:46:20,160

sttr where universities can partner with

1239
00:46:23,430 --> 00:46:22,240
or even propose on their own

1240
00:46:25,109 --> 00:46:23,440
you know innovation innovative

1241
00:46:26,630 --> 00:46:25,119
technology

1242
00:46:29,109 --> 00:46:26,640
and my company

1243
00:46:30,630 --> 00:46:29,119
is very involved in this and

1244
00:46:32,470 --> 00:46:30,640
we just started getting more involved

1245
00:46:34,710 --> 00:46:32,480
with the sttr and partnering with

1246
00:46:38,630 --> 00:46:34,720
universities because i see them as real

1247
00:46:41,430 --> 00:46:38,640
sources of innovation and as a

1248
00:46:42,710 --> 00:46:41,440
research focused

1249
00:46:44,390 --> 00:46:42,720
institution

1250
00:46:45,990 --> 00:46:44,400
their job isn't really to commercialize

1251
00:46:47,510 --> 00:46:46,000
things they may teach classes and

1252
00:46:49,589 --> 00:46:47,520
entrepreneurship but there's a point at

1253
00:46:51,750 --> 00:46:49,599
which university's responsibility ends

1254
00:46:53,190 --> 00:46:51,760
and the students have to go on and

1255
00:46:56,870 --> 00:46:53,200
become the entrepreneurs that they may

1256
00:47:02,309 --> 00:46:58,390
many people aren't aware that this

1257
00:47:05,109 --> 00:47:02,319
program is is about what 60 days from

1258
00:47:05,990 --> 00:47:05,119
being needing to be reauthorized again

1259
00:47:08,309 --> 00:47:06,000
and

1260
00:47:10,950 --> 00:47:08,319
it narrowly passed

1261
00:47:13,910 --> 00:47:10,960
got an extension to september 30th and i

1262
00:47:16,309 --> 00:47:13,920
just wanted to know what uh joe and and

1263
00:47:17,670 --> 00:47:16,319

others at nasa are doing to ensure that

1264
00:47:20,150 --> 00:47:17,680
this program

1265
00:47:23,430 --> 00:47:20,160
continues in in the future and i wanted

1266
00:47:25,270 --> 00:47:23,440
to ask uh you know dr o'shea and

1267
00:47:26,710 --> 00:47:25,280
dr barbie what are you guys doing at the

1268
00:47:29,270 --> 00:47:26,720
university level

1269
00:47:32,150 --> 00:47:29,280
to uh i'd like to see students go

1270
00:47:34,549 --> 00:47:32,160
through the sbir rfp

1271
00:47:35,750 --> 00:47:34,559
and come up with ideas that you know i

1272
00:47:36,950 --> 00:47:35,760
traditionally have to go through the

1273
00:47:38,790 --> 00:47:36,960
department and the universe and the

1274
00:47:40,150 --> 00:47:38,800
professors but they have all these other

1275
00:47:41,430 --> 00:47:40,160
things that they're doing and i think

1276
00:47:43,670 --> 00:47:41,440
there's a lot of

1277
00:47:45,670 --> 00:47:43,680
young people here who have great ideas

1278
00:47:47,349 --> 00:47:45,680
that if they look through the topic

1279
00:47:49,349 --> 00:47:47,359
lists and they thought hmm i have an

1280
00:47:50,870 --> 00:47:49,359
idea if i could just get connected with

1281
00:47:52,870 --> 00:47:50,880
someone who would

1282
00:47:54,549 --> 00:47:52,880
like to partner with me i'll promote it

1283
00:47:56,150 --> 00:47:54,559
to my professor and then we'll go do

1284
00:47:57,270 --> 00:47:56,160
these things so be more proactive in

1285
00:47:58,870 --> 00:47:57,280
that

1286
00:47:59,589 --> 00:47:58,880
so thanks

1287
00:48:01,030 --> 00:47:59,599
great

1288
00:48:03,750 --> 00:48:01,040

thank you very much

1289
00:48:05,910 --> 00:48:03,760
the sbir sttr program is one of my very

1290
00:48:09,030 --> 00:48:05,920
favorite topics so you merely push the

1291
00:48:13,589 --> 00:48:11,270
a couple of facts and a couple of

1292
00:48:16,630 --> 00:48:13,599
thoughts in relation to the the issue of

1293
00:48:19,589 --> 00:48:16,640
reauthorization and also what the proper

1294
00:48:22,150 --> 00:48:19,599
balance is between academia and industry

1295
00:48:23,910 --> 00:48:22,160
and participation in sttr

1296
00:48:26,470 --> 00:48:23,920
in particular

1297
00:48:29,109 --> 00:48:26,480
first of all the sbir program at nasa at

1298
00:48:31,589 --> 00:48:29,119
least is a fundamental

1299
00:48:33,270 --> 00:48:31,599
component of our overall research and

1300
00:48:35,750 --> 00:48:33,280
development

1301
00:48:39,030 --> 00:48:35,760
portfolio right right now the sbir

1302
00:48:42,150 --> 00:48:39,040
program at nasa is approximately 175

1303
00:48:46,390 --> 00:48:42,160
million dollar program and represents a

1304
00:48:48,150 --> 00:48:46,400
very sizable fraction of the overall r d

1305
00:48:50,069 --> 00:48:48,160
funding that's available to us within

1306
00:48:53,990 --> 00:48:50,079
the office of the chief technologist and

1307
00:48:55,030 --> 00:48:54,000
we then take uh the sbir program and and

1308
00:48:56,950 --> 00:48:55,040
apply

1309
00:48:59,190 --> 00:48:56,960
sbir research to the benefit of the

1310
00:49:01,910 --> 00:48:59,200
various mission directorates within nasa

1311
00:49:03,589 --> 00:49:01,920
and also look to commercializing those

1312
00:49:05,750 --> 00:49:03,599
those developed technologies outside of

1313
00:49:08,710 --> 00:49:05,760

nasa so it's it's endemic throughout

1314
00:49:10,230 --> 00:49:08,720
nasa's r d program uh the contributions

1315
00:49:12,549 --> 00:49:10,240
that that are being provided through

1316
00:49:13,430 --> 00:49:12,559
through sbir and sttr

1317
00:49:15,349 --> 00:49:13,440
um

1318
00:49:17,109 --> 00:49:15,359
you're also quite correct that we're

1319
00:49:18,790 --> 00:49:17,119
going through a reauthorization phase

1320
00:49:20,950 --> 00:49:18,800
within congress

1321
00:49:23,190 --> 00:49:20,960
and that the sbir program

1322
00:49:25,750 --> 00:49:23,200
there are some very

1323
00:49:29,270 --> 00:49:25,760
innovative ideas for new elements to the

1324
00:49:30,790 --> 00:49:29,280
sbir program there are some differences

1325
00:49:33,990 --> 00:49:30,800
between the house and the senate on some

1326
00:49:36,790 --> 00:49:34,000
of the the finer details of the proper

1327
00:49:38,630 --> 00:49:36,800
role of participation of venture capital

1328
00:49:40,630 --> 00:49:38,640
firms and some other elements of the

1329
00:49:43,430 --> 00:49:40,640
program but there is universal

1330
00:49:45,750 --> 00:49:43,440
bipartisan support for the notion that

1331
00:49:47,750 --> 00:49:45,760
small businesses and their research

1332
00:49:50,870 --> 00:49:47,760
partners particularly in research

1333
00:49:52,069 --> 00:49:50,880
institutions are a an incredible

1334
00:49:53,990 --> 00:49:52,079
economic

1335
00:49:55,990 --> 00:49:54,000
innovation engine

1336
00:49:58,150 --> 00:49:56,000
for technology development that can both

1337
00:50:00,150 --> 00:49:58,160
serve internal needs within the various

1338
00:50:02,630 --> 00:50:00,160

agencies that participate in the program

1339
00:50:05,589 --> 00:50:02,640
and outside through commercialization

1340
00:50:08,470 --> 00:50:05,599
just one one last quick quick note about

1341
00:50:09,990 --> 00:50:08,480
the the proper roles of of the research

1342
00:50:12,470 --> 00:50:10,000
institutions and and the small

1343
00:50:14,309 --> 00:50:12,480
businesses in sttr

1344
00:50:16,150 --> 00:50:14,319
i've had the great pleasure of being

1345
00:50:18,390 --> 00:50:16,160
associated with a number of sttr

1346
00:50:19,990 --> 00:50:18,400
projects at a sort of personal level and

1347
00:50:21,829 --> 00:50:20,000
i've also had the opportunity to observe

1348
00:50:25,190 --> 00:50:21,839
the way in which these projects

1349
00:50:27,109 --> 00:50:25,200
influence r d development within nasa

1350
00:50:29,270 --> 00:50:27,119
and i've noticed that the ones that are

1351
00:50:31,349 --> 00:50:29,280
the most successful are the ones that

1352
00:50:33,750 --> 00:50:31,359
tap the the true creative energy that

1353
00:50:35,589 --> 00:50:33,760
you have at in the academic institutions

1354
00:50:37,829 --> 00:50:35,599
and research institutions they're

1355
00:50:40,470 --> 00:50:37,839
they're where the really brilliant ideas

1356
00:50:42,470 --> 00:50:40,480
come from the fundamental kernel ideas

1357
00:50:44,630 --> 00:50:42,480
come from and then the small businesses

1358
00:50:47,990 --> 00:50:44,640
are fantastic at being able to package

1359
00:50:49,510 --> 00:50:48,000
these ideas into

1360
00:50:52,549 --> 00:50:49,520
technically

1361
00:50:58,390 --> 00:50:55,990
prototypes and and uh other ways that

1362
00:51:00,950 --> 00:50:58,400
can be adopted and each of these

1363
00:51:02,790 --> 00:51:00,960

entities play kind of a unique role but

1364
00:51:05,030 --> 00:51:02,800
a very complementary one so when you

1365
00:51:07,030 --> 00:51:05,040
have that when you have that that

1366
00:51:08,390 --> 00:51:07,040
that that partnership between the the

1367
00:51:10,150 --> 00:51:08,400
idea factory

1368
00:51:12,309 --> 00:51:10,160
and the people who can take that idea

1369
00:51:13,990 --> 00:51:12,319
and and and

1370
00:51:16,230 --> 00:51:14,000
apply the proper

1371
00:51:18,230 --> 00:51:16,240
shaping and sculpting to that idea to

1372
00:51:19,589 --> 00:51:18,240
make it real then you really have

1373
00:51:21,670 --> 00:51:19,599
something and so that's one of the

1374
00:51:23,670 --> 00:51:21,680
fundamental tenets of the sttr program

1375
00:51:25,349 --> 00:51:23,680
and i think it's fantastic

1376
00:51:26,950 --> 00:51:25,359
so thanks for the opportunity to talk

1377
00:51:29,750 --> 00:51:26,960
about it

1378
00:51:31,990 --> 00:51:29,760
i just want to add we're seeing a change

1379
00:51:34,069 --> 00:51:32,000
in leadership for sbir program under

1380
00:51:36,630 --> 00:51:34,079
under joe and we have a new

1381
00:51:39,109 --> 00:51:36,640
director of the the program rich lesnar

1382
00:51:40,790 --> 00:51:39,119
out at headquarters i just introduced

1383
00:51:43,190 --> 00:51:40,800
myself yesterday and he's really open to

1384
00:51:44,549 --> 00:51:43,200
new ideas so those you in the

1385
00:51:46,950 --> 00:51:44,559
maryland community if you want to reach

1386
00:51:49,270 --> 00:51:46,960
out to me at goddard um and funnel your

1387
00:51:51,589 --> 00:51:49,280
ideas to me and through joe or in

1388
00:51:53,670 --> 00:51:51,599

conjunction with rich i'm be very open

1389
00:51:55,270 --> 00:51:53,680
to that because i take sbir very

1390
00:51:57,270 --> 00:51:55,280
seriously it's very important that the

1391
00:51:58,950 --> 00:51:57,280
guided portfolio i work closely with the

1392
00:52:00,630 --> 00:51:58,960
sub-topic managers make sure they are

1393
00:52:02,710 --> 00:52:00,640
strategic make sure we are making

1394
00:52:06,230 --> 00:52:02,720
selections that are vital to our future

1395
00:52:11,990 --> 00:52:09,190
so i i totally agree with your comment

1396
00:52:13,589 --> 00:52:12,000
about the value of stter and sbir

1397
00:52:16,950 --> 00:52:13,599
programs i think it

1398
00:52:19,910 --> 00:52:16,960
has done the country a lot of good

1399
00:52:24,309 --> 00:52:22,309
i would i would take a little issue with

1400
00:52:26,069 --> 00:52:24,319
your statement that the university

1401
00:52:28,150 --> 00:52:26,079
responsibility ends when students

1402
00:52:29,670 --> 00:52:28,160
graduate i think it's true at most

1403
00:52:31,270 --> 00:52:29,680
universities but not at the university

1404
00:52:33,190 --> 00:52:31,280
of maryland

1405
00:52:35,990 --> 00:52:33,200
through the organization that i direct

1406
00:52:38,390 --> 00:52:36,000
mtech we have a number of programs that

1407
00:52:40,630 --> 00:52:38,400
can help students and faculty start

1408
00:52:44,470 --> 00:52:40,640
companies and we'll we'll work with them

1409
00:52:46,230 --> 00:52:44,480
for years and just let me mention a few

1410
00:52:48,630 --> 00:52:46,240
one of which is our venture accelerator

1411
00:52:50,950 --> 00:52:48,640
program where we identify the most

1412
00:52:52,390 --> 00:52:50,960
likely commercializable

1413
00:52:54,790 --> 00:52:52,400

technologies that come out of the

1414
00:52:57,109 --> 00:52:54,800
research and we will actually work with

1415
00:52:58,549 --> 00:52:57,119
those students and faculty for a period

1416
00:53:00,069 --> 00:52:58,559
up to two years

1417
00:53:01,910 --> 00:53:00,079
to actually

1418
00:53:03,109 --> 00:53:01,920
do market research put together a

1419
00:53:05,510 --> 00:53:03,119
business plan

1420
00:53:07,670 --> 00:53:05,520
bring in initial funding introduce them

1421
00:53:09,589 --> 00:53:07,680
to customers and actually bring in

1422
00:53:11,190 --> 00:53:09,599
management to take the company forward

1423
00:53:13,109 --> 00:53:11,200
if necessary

1424
00:53:15,510 --> 00:53:13,119
we've also operated an on-campus

1425
00:53:17,349 --> 00:53:15,520
incubator for 25 years

1426
00:53:18,829 --> 00:53:17,359
and from that income incubator we've

1427
00:53:23,990 --> 00:53:18,839
graduated

1428
00:53:27,270 --> 00:53:25,829
three two of which are billion dollar

1429
00:53:28,950 --> 00:53:27,280
companies that have been acquired in the

1430
00:53:29,990 --> 00:53:28,960
last two years for over a billion

1431
00:53:31,670 --> 00:53:30,000
dollars

1432
00:53:33,910 --> 00:53:31,680
one of which was the company that

1433
00:53:36,390 --> 00:53:33,920
developed the hybrid electric drive

1434
00:53:37,750 --> 00:53:36,400
for toyota and ford automobiles so we've

1435
00:53:40,150 --> 00:53:37,760
done some pretty had some pretty

1436
00:53:42,710 --> 00:53:40,160
significant successes out of that

1437
00:53:44,470 --> 00:53:42,720
we've also run a program called mips

1438
00:53:45,510 --> 00:53:44,480

maryland industrial partnerships where

1439
00:53:47,589 --> 00:53:45,520
we

1440
00:53:48,710 --> 00:53:47,599
where faculty and graduate students

1441
00:53:51,030 --> 00:53:48,720
conduct

1442
00:53:53,030 --> 00:53:51,040
projects on campus for maryland

1443
00:53:55,270 --> 00:53:53,040
companies to create new and improved

1444
00:53:57,750 --> 00:53:55,280
products for those it's basically market

1445
00:53:59,030 --> 00:53:57,760
pull and so

1446
00:54:01,510 --> 00:53:59,040
uh

1447
00:54:03,990 --> 00:54:01,520
through that program we have helped

1448
00:54:06,309 --> 00:54:04,000
companies in maryland create products

1449
00:54:08,829 --> 00:54:06,319
and services that have created revenues

1450
00:54:11,349 --> 00:54:08,839
of 21.6 billion

1451
00:54:13,990 --> 00:54:11,359
dollars actually if you look at the tax

1452
00:54:15,910 --> 00:54:14,000
money coming in back into the state

1453
00:54:20,950 --> 00:54:15,920
from that program it more than pays for

1454
00:54:24,950 --> 00:54:23,030
so we got a question through our twitter

1455
00:54:26,870 --> 00:54:24,960
account i'd like to loft it up for a

1456
00:54:27,750 --> 00:54:26,880
painless to consider

1457
00:54:29,829 --> 00:54:27,760
there is

1458
00:54:32,230 --> 00:54:29,839
the the question was

1459
00:54:33,910 --> 00:54:32,240
competition through no innovation

1460
00:54:35,990 --> 00:54:33,920
through competition is great and it's

1461
00:54:39,190 --> 00:54:36,000
very successful but what about

1462
00:54:41,430 --> 00:54:39,200
comp or innovation through the community

1463
00:54:44,470 --> 00:54:41,440

the idea of open source does anyone have

1464
00:54:46,710 --> 00:54:44,480
any comments and of open sourcing

1465
00:54:48,950 --> 00:54:46,720
innovation and technology what can make

1466
00:54:50,950 --> 00:54:48,960
it work even more effectively and other

1467
00:54:53,030 --> 00:54:50,960
ideas how we can weave it into our

1468
00:54:54,710 --> 00:54:53,040
innovation and technology

1469
00:54:55,990 --> 00:54:54,720
focus

1470
00:54:59,349 --> 00:54:56,000
well i uh

1471
00:55:03,349 --> 00:54:59,359
can offer a few comments on that i think

1472
00:55:05,750 --> 00:55:03,359
open innovation is a a great

1473
00:55:08,789 --> 00:55:05,760
and again untapped resource so if you

1474
00:55:09,589 --> 00:55:08,799
think about collective intelligence uh

1475
00:55:15,030 --> 00:55:09,599
it

1476
00:55:17,430 --> 00:55:15,040
and so when you throw out a challenge i

1477
00:55:19,750 --> 00:55:17,440
know nasa has some some like grand

1478
00:55:23,430 --> 00:55:19,760
challenge when you when you throw that

1479
00:55:26,710 --> 00:55:23,440
out and allow these diverse teams to

1480
00:55:29,349 --> 00:55:26,720
to uh to work on that you get the better

1481
00:55:30,150 --> 00:55:29,359
solutions and i think one

1482
00:55:33,190 --> 00:55:30,160
uh

1483
00:55:34,870 --> 00:55:33,200
i think emerging technology that we're

1484
00:55:36,549 --> 00:55:34,880
starting to use are things called

1485
00:55:38,789 --> 00:55:36,559
prediction markets

1486
00:55:40,870 --> 00:55:38,799
and uh so if you look at prediction

1487
00:55:43,430 --> 00:55:40,880
markets it's really uh

1488
00:55:45,109 --> 00:55:43,440

an idea market you put put a concept out

1489
00:55:47,030 --> 00:55:45,119
there and people either say yes i

1490
00:55:49,990 --> 00:55:47,040
believe this is going to happen no just

1491
00:55:52,470 --> 00:55:50,000
like a stock market for for concepts

1492
00:55:56,069 --> 00:55:52,480
and i think is really powerful because

1493
00:55:58,230 --> 00:55:56,079
it has the ability to very efficiently

1494
00:56:00,150 --> 00:55:58,240
aggregate

1495
00:56:01,349 --> 00:56:00,160
information that's coming ideas that are

1496
00:56:04,150 --> 00:56:01,359
coming from

1497
00:56:06,150 --> 00:56:04,160
very diverse sources without ruining the

1498
00:56:08,150 --> 00:56:06,160
diversity of that source

1499
00:56:10,309 --> 00:56:08,160
and uh and

1500
00:56:13,109 --> 00:56:10,319
i was able actually to convince us to

1501
00:56:15,829 --> 00:56:13,119
try to do one internally mostly because

1502
00:56:17,910 --> 00:56:15,839
nasa did one

1503
00:56:19,910 --> 00:56:17,920
in the clickworkers experiment i don't

1504
00:56:22,950 --> 00:56:19,920
know how many people are familiar with

1505
00:56:23,750 --> 00:56:22,960
that but it was a very interesting thing

1506
00:56:26,390 --> 00:56:23,760
where

1507
00:56:27,589 --> 00:56:26,400
there was so much imagery somebody else

1508
00:56:29,349 --> 00:56:27,599
might want to talk about it i'll say

1509
00:56:32,549 --> 00:56:29,359
what i think it is

1510
00:56:34,630 --> 00:56:32,559
so much imagery coming um down that that

1511
00:56:38,470 --> 00:56:34,640
it couldn't be exploited by the on-site

1512
00:56:40,789 --> 00:56:38,480
experts so you turned it over to um

1513
00:56:44,069 --> 00:56:40,799

anybody in the world uh with a little

1514
00:56:46,870 --> 00:56:44,079
bit of training they were able to

1515
00:56:48,230 --> 00:56:46,880
to put these measurements in of craters

1516
00:56:51,829 --> 00:56:48,240
i believe it was

1517
00:56:55,750 --> 00:56:51,839
and through aggregating multiple sources

1518
00:56:57,270 --> 00:56:55,760
of that you got good solutions and so i

1519
00:57:00,549 --> 00:56:57,280
think that that's the kind of thing

1520
00:57:03,430 --> 00:57:00,559
those types of open source innovation

1521
00:57:05,750 --> 00:57:03,440
enabled really by our

1522
00:57:09,510 --> 00:57:05,760
ever evolving information technology

1523
00:57:13,109 --> 00:57:11,750
i like the idea of combining

1524
00:57:15,510 --> 00:57:13,119
competition

1525
00:57:17,030 --> 00:57:15,520
with open source solutions it's good

1526
00:57:19,829 --> 00:57:17,040
when there's a reward at the end and a

1527
00:57:21,910 --> 00:57:19,839
good example of that was the darpa

1528
00:57:25,190 --> 00:57:21,920
red balloon project of a couple of years

1529
00:57:27,030 --> 00:57:25,200
ago where darpa put up a dozen or so

1530
00:57:28,549 --> 00:57:27,040
balloons at random locations around the

1531
00:57:29,910 --> 00:57:28,559
country and the competition was who

1532
00:57:33,430 --> 00:57:29,920
could figure out where they all were in

1533
00:57:35,990 --> 00:57:33,440
the shortest possible time which was

1534
00:57:39,750 --> 00:57:36,000
induced a lot of competition-based open

1535
00:57:41,270 --> 00:57:39,760
source creativity and innovation

1536
00:57:43,190 --> 00:57:41,280
there's a uh

1537
00:57:45,670 --> 00:57:43,200
you may be aware that there's a company

1538
00:57:49,030 --> 00:57:45,680

in california called audio

1539
00:57:51,349 --> 00:57:49,040
and audio uses a similar process where

1540
00:57:54,230 --> 00:57:51,359
uh typically large companies come to

1541
00:57:56,549 --> 00:57:54,240
audio and they say we need a new product

1542
00:57:57,990 --> 00:57:56,559
or an improved product developed so they

1543
00:58:01,910 --> 00:57:58,000
give them sort of

1544
00:58:04,150 --> 00:58:01,920
very broad specifications and ideo

1545
00:58:06,309 --> 00:58:04,160
brings in a group

1546
00:58:08,789 --> 00:58:06,319
extremely diverse group of individuals i

1547
00:58:09,910 --> 00:58:08,799
mean maybe psychologists engineers you

1548
00:58:13,109 --> 00:58:09,920
name it

1549
00:58:15,109 --> 00:58:13,119
and through a series of processes

1550
00:58:16,390 --> 00:58:15,119
they narrow down to

1551
00:58:17,670 --> 00:58:16,400
the most

1552
00:58:19,750 --> 00:58:17,680
innovative

1553
00:58:21,510 --> 00:58:19,760
solution to that to that

1554
00:58:24,230 --> 00:58:21,520
to that question that the larger company

1555
00:58:27,190 --> 00:58:25,670
okay thank you

1556
00:58:28,789 --> 00:58:27,200
we'll take one more question from here

1557
00:58:31,030 --> 00:58:28,799
in the audience and then wrap up the

1558
00:58:32,230 --> 00:58:31,040
panel sir

1559
00:58:33,910 --> 00:58:32,240
i would

1560
00:58:35,670 --> 00:58:33,920
like to underscore your experience with

1561
00:58:38,230 --> 00:58:35,680
a click worker program

1562
00:58:40,069 --> 00:58:38,240
but my problem right now is i can't find

1563
00:58:42,309 --> 00:58:40,079

where it went i'd like to use it in my

1564
00:58:44,630 --> 00:58:42,319
stem outreach with civil air patrol and

1565
00:58:46,630 --> 00:58:44,640
other things i can't find out where it

1566
00:58:50,069 --> 00:58:46,640
actually is going to go

1567
00:58:51,829 --> 00:58:50,079
and where what future it has so that's a

1568
00:58:54,230 --> 00:58:51,839
that's a question i keep putting to

1569
00:58:57,109 --> 00:58:54,240
folks but it was a very very nice

1570
00:59:00,390 --> 00:58:57,119
experience to actually work that and and

1571
00:59:03,030 --> 00:59:00,400
enjoy uh the exploring bits of mars or

1572
00:59:05,349 --> 00:59:03,040
whatever the the terrain happened to be

1573
00:59:07,829 --> 00:59:05,359
i think that's a very important

1574
00:59:09,030 --> 00:59:07,839
notion of getting out into the into the

1575
00:59:11,589 --> 00:59:09,040
cloud and

1576
00:59:13,829 --> 00:59:11,599
exploiting synergies but i'd like to

1577
00:59:15,829 --> 00:59:13,839
ask again

1578
00:59:18,950 --> 00:59:15,839
when you folks really look at the

1579
00:59:20,069 --> 00:59:18,960
details of how to make innovation happen

1580
00:59:22,870 --> 00:59:20,079
do you

1581
00:59:25,270 --> 00:59:22,880
spend a lot of mental energy and spend

1582
00:59:26,710 --> 00:59:25,280
some time thinking about the synergies

1583
00:59:28,630 --> 00:59:26,720
between

1584
00:59:30,789 --> 00:59:28,640
green energy technology

1585
00:59:33,829 --> 00:59:30,799
and oil independence technology and

1586
00:59:36,150 --> 00:59:33,839
exploration technology and how can we

1587
00:59:39,190 --> 00:59:36,160
really see

1588
00:59:42,390 --> 00:59:39,200

leverage between those those parts of

1589
00:59:45,670 --> 00:59:42,400
our technology in a very very real way

1590
00:59:48,069 --> 00:59:45,680
can we see programs which invite

1591
00:59:50,390 --> 00:59:48,079
really cross-disciplinary cooperation

1592
00:59:52,870 --> 00:59:50,400
between agencies you have to go across

1593
00:59:55,109 --> 00:59:52,880
agencies to this get this kind of thing

1594
00:59:58,150 --> 00:59:55,119
and can agencies

1595
01:00:01,349 --> 00:59:58,160
in in fact have sort of super sbirs and

1596
01:00:02,789 --> 01:00:01,359
super sttrs where the money is longer

1597
01:00:05,030 --> 01:00:02,799
term and the

1598
01:00:05,990 --> 01:00:05,040
and the targets are brought more broadly

1599
01:00:08,950 --> 01:00:06,000
based

1600
01:00:09,829 --> 01:00:08,960
and there is this real uh imperative to

1601
01:00:12,630 --> 01:00:09,839
say

1602
01:00:14,390 --> 01:00:12,640
look across all these problems think out

1603
01:00:16,630 --> 01:00:14,400
of the box see how

1604
01:00:19,030 --> 01:00:16,640
putting something on mars is also

1605
01:00:20,789 --> 01:00:19,040
helping you put something in somebody's

1606
01:00:23,030 --> 01:00:20,799
garage

1607
01:00:24,470 --> 01:00:23,040
what do you think

1608
01:00:26,150 --> 01:00:24,480
we're short on time but i'll comment

1609
01:00:27,829 --> 01:00:26,160
i'll react to that saying that i'm a big

1610
01:00:30,309 --> 01:00:27,839
believer the importance of reaching

1611
01:00:32,549 --> 01:00:30,319
across disciplines reaching across

1612
01:00:33,910 --> 01:00:32,559
programs reaching across agencies for

1613
01:00:35,589 --> 01:00:33,920

new innovation

1614
01:00:37,829 --> 01:00:35,599
not only the program level from the top

1615
01:00:39,270 --> 01:00:37,839
down but also encouraging the innovators

1616
01:00:40,950 --> 01:00:39,280
to always be aware what's going on

1617
01:00:42,789 --> 01:00:40,960
outside of their their existing program

1618
01:00:45,270 --> 01:00:42,799
outside of their universities so they

1619
01:00:49,670 --> 01:00:45,280
could identify new opportunities in

1620
01:00:52,870 --> 01:00:51,190
okay thank you

1621
01:00:54,549 --> 01:00:52,880
we're out of time for this panel but i

1622
01:00:56,390 --> 01:00:54,559
want to thank all of our panelists for

1623
01:00:58,630 --> 01:00:56,400
their thoughts

1624
01:01:01,030 --> 01:00:58,640
and appreciate your coming today

1625
01:01:02,230 --> 01:01:01,040
we're now going to move on to our next

1626
01:01:03,910 --> 01:01:02,240
panel

1627
01:01:05,829 --> 01:01:03,920
before we do i just like to make a

1628
01:01:07,670 --> 01:01:05,839
couple of housekeeping notes again if

1629
01:01:08,950 --> 01:01:07,680
you're watching and joining us on nasa

1630
01:01:11,109 --> 01:01:08,960
television

1631
01:01:14,950 --> 01:01:11,119
you can watch us streamed on nasa tv

1632
01:01:19,190 --> 01:01:16,789
ntv

1633
01:01:21,829 --> 01:01:19,200
uh if you're following today's

1634
01:01:29,910 --> 01:01:21,839
conversation on twitter you can join in

1635
01:01:35,030 --> 01:01:32,309
pound nasa future there we go

1636
01:01:38,230 --> 01:01:35,040
uh again you can follow us on twitter

1637
01:01:40,870 --> 01:01:38,240
using the pound nasa future or by

1638
01:01:48,230 --> 01:01:40,880

sending your questions to our panelists

1639
01:01:52,230 --> 01:01:50,309
following the next panel we're going to

1640
01:01:53,829 --> 01:01:52,240
take questions from the audience again

1641
01:01:55,589 --> 01:01:53,839
if you have questions for the panelists

1642
01:01:57,510 --> 01:01:55,599
during the q a we ask that you do use

1643
01:01:59,910 --> 01:01:57,520
the microphones in the aisle so that our

1644
01:02:00,870 --> 01:01:59,920
our viewers on tv

1645
01:02:16,549 --> 01:02:00,880
can

1646
01:02:21,910 --> 01:02:19,270
after this panel we'll be taking a break

1647
01:02:24,069 --> 01:02:21,920
a brief lunch break and then starting

1648
01:02:25,510 --> 01:02:24,079
back up again later this afternoon from

1649
01:02:26,710 --> 01:02:25,520
here at the university of maryland in

1650
01:02:46,950 --> 01:02:26,720
college park

1651
01:02:51,510 --> 01:02:49,589
our next panel as part of today's nasa

1652
01:02:55,109 --> 01:02:51,520
future forum

1653
01:02:56,549 --> 01:02:55,119
is a panel titled science and discovery

1654
01:02:58,630 --> 01:02:56,559
pushing the limits of knowledge to

1655
01:03:00,549 --> 01:02:58,640
inspire a new generation

1656
01:03:03,109 --> 01:03:00,559
which will be led by michelle thaller an

1657
01:03:04,870 --> 01:03:03,119
astrophysicist and communications expert

1658
01:03:07,589 --> 01:03:04,880
from nasa's goddard space flight center

1659
01:03:08,549 --> 01:03:07,599
here in greenbelt maryland michelle

1660
01:03:11,270 --> 01:03:08,559
thank you very much good morning

1661
01:03:15,750 --> 01:03:13,670
the idea of discovery what really is

1662
01:03:17,750 --> 01:03:15,760
coming in the future what is next it

1663
01:03:19,750 --> 01:03:17,760

it's difficult to imagine

1664
01:03:21,270 --> 01:03:19,760
the uh the world for me for example

1665
01:03:23,190 --> 01:03:21,280
before the hubble space telescope or

1666
01:03:25,430 --> 01:03:23,200
before the voyager missions you know can

1667
01:03:28,390 --> 01:03:25,440
you can you remember i i was born in

1668
01:03:30,950 --> 01:03:28,400
1970 and i never had a chance to think

1669
01:03:32,950 --> 01:03:30,960
of planetary science as just these

1670
01:03:36,230 --> 01:03:32,960
distant little lights in the sky they

1671
01:03:37,670 --> 01:03:36,240
were always worlds to me i grew up with

1672
01:03:39,270 --> 01:03:37,680
that idea

1673
01:03:40,470 --> 01:03:39,280
in our panel today we're going to talk a

1674
01:03:42,710 --> 01:03:40,480
bit about

1675
01:03:44,710 --> 01:03:42,720
the power of discovery you know what's

1676
01:03:46,549 --> 01:03:44,720
next in the future what do we see as

1677
01:03:49,029 --> 01:03:46,559
some of the most important discoveries

1678
01:03:51,510 --> 01:03:49,039
coming in our generation in our lifetime

1679
01:03:53,190 --> 01:03:51,520
and to discuss this and i'm hoping that

1680
01:03:54,789 --> 01:03:53,200
this will be led mainly by your

1681
01:03:56,470 --> 01:03:54,799
questions i would really like this to be

1682
01:03:58,470 --> 01:03:56,480
very collaborative i understand we'll

1683
01:04:00,069 --> 01:03:58,480
get questions from from twitter whoever

1684
01:04:01,829 --> 01:04:00,079
else is emailing us

1685
01:04:03,109 --> 01:04:01,839
but but please let's let's make this as

1686
01:04:05,349 --> 01:04:03,119
collaborative as possible we have some

1687
01:04:08,230 --> 01:04:05,359
of the world leaders here to talk about

1688
01:04:09,750 --> 01:04:08,240

where discovery may lead us so

1689
01:04:11,029 --> 01:04:09,760
not to waste time let's go right ahead

1690
01:04:12,710 --> 01:04:11,039
and have them introduce themselves and

1691
01:04:14,710 --> 01:04:12,720
give a short introduction and then we'll

1692
01:04:16,950 --> 01:04:14,720
open up to your questions thank you

1693
01:04:21,109 --> 01:04:16,960
so i'm waleed abdullahi i'm the chief

1694
01:04:23,829 --> 01:04:21,119
scientist at nasa which is a great gig

1695
01:04:25,510 --> 01:04:23,839
actually because every day i'm totally

1696
01:04:27,430 --> 01:04:25,520
blown away by

1697
01:04:29,910 --> 01:04:27,440
something nasa is doing or other

1698
01:04:32,870 --> 01:04:29,920
agencies space agencies are doing

1699
01:04:35,349 --> 01:04:32,880
that that's phenomenal

1700
01:04:37,750 --> 01:04:35,359
and what i like about it and what i

1701
01:04:40,069 --> 01:04:37,760
think sort of has us all roped in is

1702
01:04:41,510 --> 01:04:40,079
that from the beginning of time people

1703
01:04:43,510 --> 01:04:41,520
have looked up

1704
01:04:45,510 --> 01:04:43,520
and wondered we've looked at stars we've

1705
01:04:47,430 --> 01:04:45,520
looked at planets and just been filled

1706
01:04:49,750 --> 01:04:47,440
with questions about

1707
01:04:52,549 --> 01:04:49,760
what they're like how they came to be

1708
01:04:55,430 --> 01:04:52,559
you know what our place in the universe

1709
01:04:58,150 --> 01:04:55,440
is you know by looking outward it

1710
01:05:01,349 --> 01:04:58,160
prompts some very profound questions

1711
01:05:03,670 --> 01:05:01,359
uh inwardly and as our capabilities

1712
01:05:05,349 --> 01:05:03,680
evolve we actually have gone out there

1713
01:05:07,510 --> 01:05:05,359

and been able to look back at our own

1714
01:05:09,029 --> 01:05:07,520
earth which has triggered another set of

1715
01:05:10,950 --> 01:05:09,039
questions about

1716
01:05:13,670 --> 01:05:10,960
the the um

1717
01:05:15,589 --> 01:05:13,680
the planet we live on how it functions

1718
01:05:17,670 --> 01:05:15,599
how it's changing what it will look like

1719
01:05:19,829 --> 01:05:17,680
in the future and i just want to sort of

1720
01:05:21,029 --> 01:05:19,839
plant a few seeds because the main the

1721
01:05:23,750 --> 01:05:21,039
main

1722
01:05:30,069 --> 01:05:23,760
purpose of this is to be conversational

1723
01:05:35,589 --> 01:05:33,270
what we do in science at nasa is

1724
01:05:37,270 --> 01:05:35,599
unbelievable it really is the stuff of

1725
01:05:39,510 --> 01:05:37,280
dreams and if you heard what i said in

1726
01:05:40,870 --> 01:05:39,520
the beginning our dreams are becoming

1727
01:05:43,270 --> 01:05:40,880
our successes

1728
01:05:45,589 --> 01:05:43,280
we look to the edges of the universe and

1729
01:05:48,549 --> 01:05:45,599
the beginning of time as we understand

1730
01:05:51,750 --> 01:05:48,559
it back very close to the big bang over

1731
01:05:54,470 --> 01:05:51,760
13 billion years back into the past

1732
01:05:56,710 --> 01:05:54,480
we look at the planets our celestial

1733
01:05:59,029 --> 01:05:56,720
neighbors in the solar system that are

1734
01:06:00,549 --> 01:05:59,039
providing clues as to how

1735
01:06:04,230 --> 01:06:00,559
we came to be

1736
01:06:05,270 --> 01:06:04,240
how the earth has formed and evolved and

1737
01:06:07,430 --> 01:06:05,280
perhaps

1738
01:06:10,390 --> 01:06:07,440

where it might be going

1739
01:06:12,950 --> 01:06:10,400
just very basic questions about life

1740
01:06:16,789 --> 01:06:12,960
about survival about evolution

1741
01:06:19,510 --> 01:06:16,799
we look at the sun in ways that

1742
01:06:22,230 --> 01:06:19,520
are essentially impossible without going

1743
01:06:23,510 --> 01:06:22,240
to or near it um and a lot of people

1744
01:06:25,829 --> 01:06:23,520
think you know the fundamental

1745
01:06:28,309 --> 01:06:25,839
ingredient of life is plants life on

1746
01:06:30,789 --> 01:06:28,319
earth human life is plants i'll go one

1747
01:06:32,950 --> 01:06:30,799
step further and say it's photons

1748
01:06:35,829 --> 01:06:32,960
you know those plants turn photons into

1749
01:06:38,789 --> 01:06:35,839
glucose that that form the foundation of

1750
01:06:41,589 --> 01:06:38,799
the food chain so understanding the sun

1751
01:06:44,870 --> 01:06:41,599
that fuels life on earth

1752
01:06:48,390 --> 01:06:44,880
is an incredible pursuit and undertaking

1753
01:06:50,230 --> 01:06:48,400
and finally the planet we live on today

1754
01:06:53,910 --> 01:06:50,240
and perhaps more importantly the planet

1755
01:06:55,510 --> 01:06:53,920
our descendants will live on tomorrow um

1756
01:06:58,710 --> 01:06:55,520
there is value

1757
01:07:00,710 --> 01:06:58,720
to knowing what tomorrow will bring

1758
01:07:03,670 --> 01:07:00,720
it's it's important for

1759
01:07:05,829 --> 01:07:03,680
our success as a species on this planet

1760
01:07:08,150 --> 01:07:05,839
and it looks like i skipped over in my

1761
01:07:10,309 --> 01:07:08,160
notes uh well when i talked about our

1762
01:07:12,150 --> 01:07:10,319
celestial neighbors i want to remind

1763
01:07:15,190 --> 01:07:12,160

people you know the the prospect of

1764
01:07:17,829 --> 01:07:15,200
liquid water on the surface of mars the

1765
01:07:20,630 --> 01:07:17,839
prospect is or the observation as i said

1766
01:07:23,510 --> 01:07:20,640
earlier of methane raindrops on the

1767
01:07:25,349 --> 01:07:23,520
surface of titan

1768
01:07:27,589 --> 01:07:25,359
learning about

1769
01:07:29,829 --> 01:07:27,599
the history of the solar system that's

1770
01:07:33,029 --> 01:07:29,839
been erased by tectonics on our own

1771
01:07:34,950 --> 01:07:33,039
planet by looking at things

1772
01:07:37,589 --> 01:07:34,960
back four and a half billion years to

1773
01:07:39,670 --> 01:07:37,599
the start of our solar system so

1774
01:07:41,990 --> 01:07:39,680
deep space beginning of time our

1775
01:07:44,309 --> 01:07:42,000
celestial neighbors the sun that fuels

1776
01:07:45,109 --> 01:07:44,319
us our very own planet i mean what could

1777
01:07:47,349 --> 01:07:45,119
be

1778
01:07:50,230 --> 01:07:47,359
more important endeavors

1779
01:07:51,190 --> 01:07:50,240
so i find the science at nasa as i said

1780
01:07:53,829 --> 01:07:51,200
earlier

1781
01:07:56,069 --> 01:07:53,839
inspiring and i find it of a great

1782
01:07:57,910 --> 01:07:56,079
service to humankind

1783
01:08:00,630 --> 01:07:57,920
the tagline for the office of the chief

1784
01:08:02,789 --> 01:08:00,640
scientist is science to inspire and

1785
01:08:05,670 --> 01:08:02,799
science to serve

1786
01:08:08,549 --> 01:08:05,680
there's a tremendous beautiful amazing

1787
01:08:11,349 --> 01:08:08,559
magnificent magical universe out there

1788
01:08:13,750 --> 01:08:11,359

and as we peer out into it and go toward

1789
01:08:15,670 --> 01:08:13,760
it and look back

1790
01:08:17,510 --> 01:08:15,680
i think the secrets we're revealing and

1791
01:08:20,390 --> 01:08:17,520
we'll continue to reveal

1792
01:08:21,910 --> 01:08:20,400
will blow us away and and serve us all

1793
01:08:24,550 --> 01:08:21,920
well

1794
01:08:25,829 --> 01:08:24,560
with that uh i'll go back to michelle

1795
01:08:28,149 --> 01:08:25,839
thank you david

1796
01:08:29,829 --> 01:08:28,159
thank you michelle i'm uh david pierce

1797
01:08:33,189 --> 01:08:29,839
and i'm here to this morning to

1798
01:08:34,950 --> 01:08:33,199
represent the nasa suborbital program um

1799
01:08:36,709 --> 01:08:34,960
i would suggest to you

1800
01:08:39,510 --> 01:08:36,719
that you cannot

1801
01:08:41,349 --> 01:08:39,520
talk about earth and space science

1802
01:08:42,789 --> 01:08:41,359
discovery

1803
01:08:45,269 --> 01:08:42,799
and innovation

1804
01:08:47,829 --> 01:08:45,279
without also talking about nasa's

1805
01:08:50,309 --> 01:08:47,839
suborbital program since the earliest

1806
01:08:52,870 --> 01:08:50,319
days of the agency

1807
01:08:53,990 --> 01:08:52,880
nasa's sounding rockets balloons and

1808
01:08:57,349 --> 01:08:54,000
aircraft

1809
01:08:59,030 --> 01:08:57,359
have enabled discovery by as what waleed

1810
01:09:02,550 --> 01:08:59,040
was talking about working with

1811
01:09:05,349 --> 01:09:02,560
researchers to take a dream turn it into

1812
01:09:08,149 --> 01:09:05,359
a prototype piece of hardware fly it for

1813
01:09:11,110 --> 01:09:08,159

the first time and if it doesn't work

1814
01:09:13,590 --> 01:09:11,120
they go back rebuild it rework it re-fly

1815
01:09:15,910 --> 01:09:13,600
it until it's right before they put it

1816
01:09:17,990 --> 01:09:15,920
on orbit

1817
01:09:21,110 --> 01:09:18,000
the mission of the suborbital program at

1818
01:09:22,709 --> 01:09:21,120
nasa is simply to support science

1819
01:09:25,030 --> 01:09:22,719
we're like that german

1820
01:09:27,030 --> 01:09:25,040
chemical company we don't do the science

1821
01:09:29,829 --> 01:09:27,040
we make the science better

1822
01:09:32,950 --> 01:09:29,839
we enable the scientists at nasa to take

1823
01:09:34,550 --> 01:09:32,960
that idea and to turn that experiment

1824
01:09:37,269 --> 01:09:34,560
and that concept

1825
01:09:40,390 --> 01:09:37,279
into detectors to make state-of-the-art

1826
01:09:42,789 --> 01:09:40,400
measurements to validate models such as

1827
01:09:44,709 --> 01:09:42,799
the ozone hole or

1828
01:09:47,189 --> 01:09:44,719
develop technologies that will become

1829
01:09:50,390 --> 01:09:47,199
part of a spacecraft

1830
01:09:51,749 --> 01:09:50,400
over the last three decades over five

1831
01:09:53,829 --> 01:09:51,759
dozen

1832
01:09:56,149 --> 01:09:53,839
instruments have been developed on

1833
01:09:59,189 --> 01:09:56,159
nasa's aircraft sounding rockets and

1834
01:10:01,910 --> 01:09:59,199
balloons that have gone on to fly on

1835
01:10:03,350 --> 01:10:01,920
nasa's spacecraft to do both earth and

1836
01:10:05,430 --> 01:10:03,360
space science

1837
01:10:08,229 --> 01:10:05,440
that's quite an accomplishment and it's

1838
01:10:11,270 --> 01:10:08,239

because the suborbital platform serves

1839
01:10:13,510 --> 01:10:11,280
as a flying laboratory where both

1840
01:10:14,790 --> 01:10:13,520
researchers and the students that that

1841
01:10:15,669 --> 01:10:14,800
work with them

1842
01:10:18,950 --> 01:10:15,679
can

1843
01:10:22,310 --> 01:10:18,960
experiment try something new

1844
01:10:24,229 --> 01:10:22,320
collaborate with others and work it out

1845
01:10:25,910 --> 01:10:24,239
before it becomes part of a space

1846
01:10:29,030 --> 01:10:25,920
mission

1847
01:10:31,189 --> 01:10:29,040
instruments have a long history in nasa

1848
01:10:33,189 --> 01:10:31,199
and along the way of working on those

1849
01:10:35,030 --> 01:10:33,199
instruments we've also developed the

1850
01:10:36,229 --> 01:10:35,040
next generation of scientists and

1851
01:10:38,630 --> 01:10:36,239
engineers

1852
01:10:40,709 --> 01:10:38,640
in fact it's one of the finest training

1853
01:10:42,630 --> 01:10:40,719
grounds for innovation that we have in

1854
01:10:45,830 --> 01:10:42,640
the agency and probably one of the best

1855
01:10:47,830 --> 01:10:45,840
kept secrets of the agency is today's

1856
01:10:50,310 --> 01:10:47,840
science leaders

1857
01:10:53,030 --> 01:10:50,320
got their start in suborbital

1858
01:10:55,750 --> 01:10:53,040
one example would be a young scientist

1859
01:10:57,990 --> 01:10:55,760
who was a graduate student at berkeley

1860
01:11:01,110 --> 01:10:58,000
whose thesis was to measure the cosmic

1861
01:11:03,669 --> 01:11:01,120
microwave background radiation

1862
01:11:06,870 --> 01:11:03,679
he had an idea of what they wanted to

1863
01:11:09,830 --> 01:11:06,880

work on but along the way he learned to

1864
01:11:11,750 --> 01:11:09,840
solder and learned about optics and he

1865
01:11:14,550 --> 01:11:11,760
put his science payload together and the

1866
01:11:16,390 --> 01:11:14,560
first time he flew it it didn't work

1867
01:11:19,189 --> 01:11:16,400
and so they took it back and they

1868
01:11:20,630 --> 01:11:19,199
reworked it and re-flew it he graduated

1869
01:11:22,390 --> 01:11:20,640
and got his uh

1870
01:11:24,470 --> 01:11:22,400
doctoral thesis done

1871
01:11:26,950 --> 01:11:24,480
and then he went on to design the kobe

1872
01:11:29,990 --> 01:11:26,960
mission and of course dr john mather

1873
01:11:32,070 --> 01:11:30,000
went on to accomplish much more uh

1874
01:11:35,110 --> 01:11:32,080
receiving the nobel prize for physics in

1875
01:11:39,350 --> 01:11:35,120
2006 but it all started as a graduate

1876
01:11:43,350 --> 01:11:39,360
student working on suborbital platforms

1877
01:11:46,790 --> 01:11:43,360
so anyway i i just suffice to say

1878
01:11:49,270 --> 01:11:46,800
we help enable science and innovation

1879
01:11:51,189 --> 01:11:49,280
and we help develop the next generation

1880
01:11:52,149 --> 01:11:51,199
of scientists and engineers

1881
01:11:53,510 --> 01:11:52,159
michelle

1882
01:11:54,950 --> 01:11:53,520
i have to say i was commenting to david

1883
01:11:56,790 --> 01:11:54,960
this morning that one of the the public

1884
01:11:57,750 --> 01:11:56,800
misconceptions about nasa's suborbital

1885
01:12:00,149 --> 01:11:57,760
program

1886
01:12:02,229 --> 01:12:00,159
is that uh people don't often think that

1887
01:12:03,990 --> 01:12:02,239
it is doing cutting-edge cosmology for

1888
01:12:05,510 --> 01:12:04,000

example and uh some of the balloon

1889
01:12:06,709 --> 01:12:05,520
missions that are going up right now are

1890
01:12:08,870 --> 01:12:06,719
doing things like studying the

1891
01:12:10,470 --> 01:12:08,880
polarization of the microwave background

1892
01:12:13,350 --> 01:12:10,480
looking for clues of pre-inflation

1893
01:12:15,430 --> 01:12:13,360
physics the uh the depth of science that

1894
01:12:17,830 --> 01:12:15,440
the uh the sub-orbital program does is

1895
01:12:19,110 --> 01:12:17,840
is compelling and and challenging to

1896
01:12:21,030 --> 01:12:19,120
communicate to the public that that's

1897
01:12:23,189 --> 01:12:21,040
the case and so i think i'll go on then

1898
01:12:25,110 --> 01:12:23,199
demand

1899
01:12:27,750 --> 01:12:25,120
thank you very much i'm matt mountain

1900
01:12:30,310 --> 01:12:27,760
i run the space telescope science

1901
01:12:32,790 --> 01:12:30,320
institute which runs the science program

1902
01:12:34,310 --> 01:12:32,800
for nasa for the hubble space telescope

1903
01:12:36,070 --> 01:12:34,320
and when i tried to work out what i

1904
01:12:37,270 --> 01:12:36,080
wanted to be in high school and then in

1905
01:12:38,310 --> 01:12:37,280
graduate school i couldn't work out

1906
01:12:39,590 --> 01:12:38,320
whether i wanted to be a theoretical

1907
01:12:43,750 --> 01:12:39,600
physicist

1908
01:12:45,350 --> 01:12:43,760
an engineer or something

1909
01:12:47,189 --> 01:12:45,360
and i chose astronomy in the end because

1910
01:12:50,310 --> 01:12:47,199
you could be all of the above

1911
01:12:52,550 --> 01:12:50,320
because astronomy is a technology

1912
01:12:54,310 --> 01:12:52,560
technologically led and drives

1913
01:12:56,550 --> 01:12:54,320

technology as well i mean ever since

1914
01:12:58,149 --> 01:12:56,560
galileo lifted that telescope up 400

1915
01:13:00,790 --> 01:12:58,159
years ago

1916
01:13:03,750 --> 01:13:00,800
technology has defined the direction of

1917
01:13:06,229 --> 01:13:03,760
modern astronomy and astrophysics and it

1918
01:13:09,510 --> 01:13:06,239
hasn't been more so than in space

1919
01:13:11,270 --> 01:13:09,520
science you know it was in 1946

1920
01:13:13,350 --> 01:13:11,280
way before the space age that lyman

1921
01:13:15,830 --> 01:13:13,360
spitzer wrote a paper for something

1922
01:13:18,030 --> 01:13:15,840
called the rand project of the boeing

1923
01:13:20,550 --> 01:13:18,040
company saying we need to have

1924
01:13:22,229 --> 01:13:20,560
extraterrestrial telescopes because this

1925
01:13:24,149 --> 01:13:22,239
is what you could do

1926
01:13:26,790 --> 01:13:24,159
now we all know

1927
01:13:29,590 --> 01:13:26,800
years later it wasn't until 1990 that

1928
01:13:31,669 --> 01:13:29,600
astronomers actually got that technology

1929
01:13:32,870 --> 01:13:31,679
of the hubble space telescope but in the

1930
01:13:35,030 --> 01:13:32,880
interim

1931
01:13:37,990 --> 01:13:35,040
that science fiction idea had been put

1932
01:13:39,590 --> 01:13:38,000
to great use by other agencies

1933
01:13:42,229 --> 01:13:39,600
and the hubble was in fact the fourth or

1934
01:13:43,750 --> 01:13:42,239
fifth of those technologies

1935
01:13:45,430 --> 01:13:43,760
and look what's happened when we've

1936
01:13:48,470 --> 01:13:45,440
taken those technologies and put them in

1937
01:13:50,550 --> 01:13:48,480
the public domain i mean which

1938
01:13:52,310 --> 01:13:50,560

discovery can you think of that hasn't

1939
01:13:53,910 --> 01:13:52,320
come from the hubble space telescope you

1940
01:13:56,229 --> 01:13:53,920
know when do you get a new york times

1941
01:13:58,070 --> 01:13:56,239
editorial that writes it has taught us

1942
01:14:00,310 --> 01:13:58,080
to see the properties of a universe

1943
01:14:02,790 --> 01:14:00,320
humans have been able for most of their

1944
01:14:03,830 --> 01:14:02,800
history to probe only with their

1945
01:14:07,030 --> 01:14:03,840
thoughts

1946
01:14:09,110 --> 01:14:07,040
that's a nasa mission a science mission

1947
01:14:11,510 --> 01:14:09,120
much more tangibly

1948
01:14:13,750 --> 01:14:11,520
at the institute we have teachers

1949
01:14:16,470 --> 01:14:13,760
we create curricula

1950
01:14:17,669 --> 01:14:16,480
all 50 states use the education program

1951
01:14:21,189 --> 01:14:17,679
that flows from the hubble space

1952
01:14:24,390 --> 01:14:21,199
telescope half of the largest

1953
01:14:27,110 --> 01:14:24,400
state department of education

1954
01:14:29,750 --> 01:14:27,120
recommend hubble inspired maths and

1955
01:14:30,870 --> 01:14:29,760
reading programs for their curricula

1956
01:14:34,790 --> 01:14:30,880
every year

1957
01:14:36,390 --> 01:14:34,800
five hundred thousand teachers

1958
01:14:37,510 --> 01:14:36,400
use our programs

1959
01:14:38,310 --> 01:14:37,520
they touch

1960
01:14:41,270 --> 01:14:38,320
six

1961
01:14:43,030 --> 01:14:41,280
million kids a year

1962
01:14:45,189 --> 01:14:43,040
this is about science education it's not

1963
01:14:47,510 --> 01:14:45,199

about astronomy because people are

1964
01:14:48,950 --> 01:14:47,520
inspired by what they do at the tertiary

1965
01:14:50,310 --> 01:14:48,960
level what does this mean well the

1966
01:14:52,149 --> 01:14:50,320
hubble space telescope is a great

1967
01:14:54,790 --> 01:14:52,159
science mission but we also over the

1968
01:14:55,669 --> 01:14:54,800
course have funded 300 million dollars

1969
01:14:57,830 --> 01:14:55,679
worth

1970
01:15:00,630 --> 01:14:57,840
of young researcher funding in

1971
01:15:04,070 --> 01:15:00,640
universities and why is that important

1972
01:15:05,830 --> 01:15:04,080
well only seven percent

1973
01:15:07,669 --> 01:15:05,840
of those people those post docs those

1974
01:15:09,350 --> 01:15:07,679
undergrads actually end up as faculty

1975
01:15:12,550 --> 01:15:09,360
astronomers

1976
01:15:14,149 --> 01:15:12,560
so where do the 150 people every year go

1977
01:15:16,870 --> 01:15:14,159
they go into industry they go into

1978
01:15:18,950 --> 01:15:16,880
educators phd rocket scientists that

1979
01:15:20,390 --> 01:15:18,960
wouldn't have been phd rocket scientists

1980
01:15:22,830 --> 01:15:20,400
going into the infrastructure of this

1981
01:15:25,830 --> 01:15:22,840
country because of telescopes like the

1982
01:15:28,149 --> 01:15:25,840
hubble so what about the future

1983
01:15:29,750 --> 01:15:28,159
well we're already working on the

1984
01:15:30,950 --> 01:15:29,760
successes of the hubble space telescope

1985
01:15:32,630 --> 01:15:30,960
it's called the james webb space

1986
01:15:33,990 --> 01:15:32,640
telescope and it's been in the press a

1987
01:15:34,790 --> 01:15:34,000
little bit recently

1988
01:15:36,550 --> 01:15:34,800

and

1989
01:15:38,149 --> 01:15:36,560
but it's an amazing telescope it's the

1990
01:15:39,750 --> 01:15:38,159
largest space telescope that's ever

1991
01:15:42,630 --> 01:15:39,760
going to be flown

1992
01:15:45,270 --> 01:15:42,640
but the reason it's possible is because

1993
01:15:46,870 --> 01:15:45,280
of a huge investment made

1994
01:15:48,950 --> 01:15:46,880
in industry

1995
01:15:51,189 --> 01:15:48,960
by other agencies and other parts of the

1996
01:15:53,350 --> 01:15:51,199
government we are benefiting from the

1997
01:15:55,510 --> 01:15:53,360
ability to build extraordinary large

1998
01:15:57,510 --> 01:15:55,520
structures in space that can deploy that

1999
01:15:58,950 --> 01:15:57,520
are today used in the national defense

2000
01:16:01,270 --> 01:15:58,960
era

2001
01:16:03,750 --> 01:16:01,280
and by actually commercial satellite

2002
01:16:05,669 --> 01:16:03,760
providers to beam high definition tv

2003
01:16:08,550 --> 01:16:05,679
down to you and i

2004
01:16:10,709 --> 01:16:08,560
but what astronomy shows and investing

2005
01:16:12,870 --> 01:16:10,719
in these technologies proves is that you

2006
01:16:14,149 --> 01:16:12,880
also to make these technologies do

2007
01:16:17,189 --> 01:16:14,159
science

2008
01:16:18,630 --> 01:16:17,199
they have to reach even further to make

2009
01:16:21,430 --> 01:16:18,640
something like the james webb space

2010
01:16:23,590 --> 01:16:21,440
telescope we've had to take mirrors 18

2011
01:16:24,870 --> 01:16:23,600
of them made a beryllium that are so

2012
01:16:27,430 --> 01:16:24,880
smooth if you took the mirror and you

2013
01:16:29,750 --> 01:16:27,440

stretched it across the us the largest

2014
01:16:31,110 --> 01:16:29,760
bump on there would be about two inches

2015
01:16:33,189 --> 01:16:31,120
across

2016
01:16:36,550 --> 01:16:33,199
these technologies can be used again and

2017
01:16:37,510 --> 01:16:36,560
again whether it be for detectors

2018
01:16:39,510 --> 01:16:37,520
and

2019
01:16:42,149 --> 01:16:39,520
the james webb spray telescope for the

2020
01:16:45,590 --> 01:16:42,159
very first time puts nasa in the pole

2021
01:16:49,030 --> 01:16:45,600
position to lead nasa now has the

2022
01:16:50,709 --> 01:16:49,040
largest space telescope on the block

2023
01:16:52,070 --> 01:16:50,719
and other agencies will be looking at

2024
01:16:54,950 --> 01:16:52,080
those technologies and thinking what

2025
01:16:57,910 --> 01:16:54,960
else can we do how else can we actually

2026
01:16:59,750 --> 01:16:57,920
use these technologies in the next 20 30

2027
01:17:02,390 --> 01:16:59,760
years to actually benefit the nation

2028
01:17:03,990 --> 01:17:02,400
whether looking up or looking down so

2029
01:17:05,510 --> 01:17:04,000
what about the future looking beyond

2030
01:17:07,189 --> 01:17:05,520
that see the james webb space telescope

2031
01:17:09,910 --> 01:17:07,199
if you look at the broad stretch of

2032
01:17:12,149 --> 01:17:09,920
science as well he tried to point out

2033
01:17:14,550 --> 01:17:12,159
it's only a stepping stone to the

2034
01:17:16,950 --> 01:17:14,560
ultimate question because what astronomy

2035
01:17:18,149 --> 01:17:16,960
and astrophysics ultimately can tell you

2036
01:17:20,709 --> 01:17:18,159
is

2037
01:17:22,550 --> 01:17:20,719
that question that we as a species have

2038
01:17:23,910 --> 01:17:22,560

yearned ever since we looked up at the

2039
01:17:25,990 --> 01:17:23,920
sky

2040
01:17:28,149 --> 01:17:26,000
are we alone

2041
01:17:30,390 --> 01:17:28,159
we're on the verge

2042
01:17:32,550 --> 01:17:30,400
this generation is on the verge because

2043
01:17:33,669 --> 01:17:32,560
of the technology investments nasa has

2044
01:17:36,310 --> 01:17:33,679
made

2045
01:17:38,709 --> 01:17:36,320
nasa is uniquely positioned to answer

2046
01:17:41,590 --> 01:17:38,719
that very fundamental question are we

2047
01:17:43,590 --> 01:17:41,600
alone because we've learned so much with

2048
01:17:45,830 --> 01:17:43,600
nasa space telescopes we know there are

2049
01:17:48,070 --> 01:17:45,840
now thousands of planets out there we

2050
01:17:50,310 --> 01:17:48,080
know what's in their atmospheres we know

2051
01:17:52,229 --> 01:17:50,320
where all the stars are

2052
01:17:54,149 --> 01:17:52,239
so the very first time in human history

2053
01:17:56,470 --> 01:17:54,159
because of the investments that nasa can

2054
01:17:58,790 --> 01:17:56,480
make and has made we could build

2055
01:18:01,030 --> 01:17:58,800
telescopes which are even greater than

2056
01:18:02,870 --> 01:18:01,040
the james webb space telescope

2057
01:18:05,669 --> 01:18:02,880
that actually could answer that profound

2058
01:18:07,830 --> 01:18:05,679
question and think how transformational

2059
01:18:10,310 --> 01:18:07,840
that would be if you found life around

2060
01:18:13,189 --> 01:18:10,320
another star it would probably be as

2061
01:18:15,030 --> 01:18:13,199
transformational as copernicus and

2062
01:18:16,630 --> 01:18:15,040
darwin combined because of the

2063
01:18:18,070 --> 01:18:16,640

investments nasa makes and these kind of

2064
01:18:19,590 --> 01:18:18,080
technologies think of the kids that

2065
01:18:21,430 --> 01:18:19,600
would be inspired because of the very

2066
01:18:23,510 --> 01:18:21,440
first time they would know there's a

2067
01:18:25,270 --> 01:18:23,520
pandora out there that they could

2068
01:18:26,790 --> 01:18:25,280
possibly get to

2069
01:18:28,070 --> 01:18:26,800
suddenly you begin kids bringing you

2070
01:18:29,430 --> 01:18:28,080
think about how would i build a rocket

2071
01:18:31,270 --> 01:18:29,440
to do that what else would i understand

2072
01:18:33,910 --> 01:18:31,280
what biology do i need to know what do i

2073
01:18:36,070 --> 01:18:33,920
have to know about planets or

2074
01:18:37,030 --> 01:18:36,080
or climates

2075
01:18:39,590 --> 01:18:37,040
maybe

2076
01:18:40,390 --> 01:18:39,600
the discovery of life around another

2077
01:18:42,470 --> 01:18:40,400
star

2078
01:18:45,350 --> 01:18:42,480
would be as profound for the 21st

2079
01:18:46,390 --> 01:18:45,360
century as neil armstrong's footsteps

2080
01:18:49,110 --> 01:18:46,400
were

2081
01:18:50,070 --> 01:18:49,120
to the 20th

2082
01:18:51,510 --> 01:18:50,080
the

2083
01:18:53,830 --> 01:18:51,520
one thing that working at nasa sort of

2084
01:18:55,270 --> 01:18:53,840
has us poised to do is take a little

2085
01:18:56,790 --> 01:18:55,280
look over that that hill mat and you're

2086
01:18:59,910 --> 01:18:56,800
talking about the possible discovery of

2087
01:19:01,590 --> 01:18:59,920
life i i often say to children you know

2088
01:19:03,189 --> 01:19:01,600

that are in kindergarten that you know i

2089
01:19:04,390 --> 01:19:03,199
would like their by the time they were

2090
01:19:06,470 --> 01:19:04,400
in graduate school i would like there to

2091
01:19:07,350 --> 01:19:06,480
be a solid example of life outside the

2092
01:19:09,669 --> 01:19:07,360
earth

2093
01:19:11,990 --> 01:19:09,679
you know whether it's on mars especially

2094
01:19:13,590 --> 01:19:12,000
with these salt water flows that we're

2095
01:19:15,350 --> 01:19:13,600
seeing with with the seasonal methane

2096
01:19:16,470 --> 01:19:15,360
emission that's observed on mars or

2097
01:19:18,550 --> 01:19:16,480
whether it's something that the james

2098
01:19:21,350 --> 01:19:18,560
webb space telescope finds an oxygen

2099
01:19:24,149 --> 01:19:21,360
line in a far away planet's atmosphere

2100
01:19:26,149 --> 01:19:24,159
we really may be in the last generation

2101
01:19:27,669 --> 01:19:26,159
not to know the answer to is there life

2102
01:19:29,430 --> 01:19:27,679
outside the earth

2103
01:19:31,189 --> 01:19:29,440
that's really true

2104
01:19:33,270 --> 01:19:31,199
and i i agree with you that this could

2105
01:19:35,110 --> 01:19:33,280
be profoundly transformational and we're

2106
01:19:38,070 --> 01:19:35,120
just on the cusp of it and only nasa can

2107
01:19:41,110 --> 01:19:39,350
tony

2108
01:19:43,189 --> 01:19:41,120
so good morning everybody

2109
01:19:44,550 --> 01:19:43,199
my name is tony busalaki and i head up

2110
01:19:46,149 --> 01:19:44,560
the earth systems science

2111
01:19:47,990 --> 01:19:46,159
interdisciplinary center here at the

2112
01:19:50,790 --> 01:19:48,000
university of maryland

2113
01:19:51,830 --> 01:19:50,800

our center essec is joint between nasa

2114
01:19:54,070 --> 01:19:51,840
and noaa

2115
01:19:56,550 --> 01:19:54,080
and prior to coming here

2116
01:19:58,310 --> 01:19:56,560
to the university of maryland 2000 i was

2117
01:19:59,669 --> 01:19:58,320
at the nasa goddard space flight center

2118
01:20:01,350 --> 01:19:59,679
for 18 years

2119
01:20:03,510 --> 01:20:01,360
as a civil servant so my remarks this

2120
01:20:06,070 --> 01:20:03,520
morning are going to be predicated on my

2121
01:20:07,510 --> 01:20:06,080
experiences at nasa here at the

2122
01:20:08,950 --> 01:20:07,520
university

2123
01:20:11,110 --> 01:20:08,960
and also

2124
01:20:14,390 --> 01:20:11,120
someone who delves a lot in sort of

2125
01:20:17,590 --> 01:20:14,400
international environmental research

2126
01:20:20,950 --> 01:20:17,600
the whole field of earth system science

2127
01:20:24,229 --> 01:20:20,960
really owes its genesis to nasa

2128
01:20:26,229 --> 01:20:24,239
uh going back to 1980s and the 1990s

2129
01:20:28,709 --> 01:20:26,239
when we talk about earth system science

2130
01:20:29,669 --> 01:20:28,719
we are literally talking about how the

2131
01:20:33,030 --> 01:20:29,679
earth

2132
01:20:34,229 --> 01:20:33,040
acts as a system how the atmosphere how

2133
01:20:36,629 --> 01:20:34,239
the ocean

2134
01:20:38,790 --> 01:20:36,639
how the land surfaces coupled together

2135
01:20:39,910 --> 01:20:38,800
how those component parts of the earth

2136
01:20:43,510 --> 01:20:39,920
system

2137
01:20:46,149 --> 01:20:43,520
add up to give the puzzle uh the fabric

2138
01:20:48,550 --> 01:20:46,159

of life that we live on in this planet

2139
01:20:49,830 --> 01:20:48,560
how these individual components give

2140
01:20:52,470 --> 01:20:49,840
rise to

2141
01:20:54,870 --> 01:20:52,480
natural fluctuations

2142
01:20:56,790 --> 01:20:54,880
and then how has man's presence on this

2143
01:20:59,110 --> 01:20:56,800
planet altered

2144
01:21:02,709 --> 01:20:59,120
these natural fluctuations and it's

2145
01:21:05,030 --> 01:21:02,719
really only that perspective that space

2146
01:21:06,870 --> 01:21:05,040
affords us viewing from

2147
01:21:09,270 --> 01:21:06,880
satellite platforms where the lens is

2148
01:21:12,629 --> 01:21:09,280
turned back to our planet that we can

2149
01:21:15,189 --> 01:21:12,639
really appreciate how our planet acts as

2150
01:21:17,750 --> 01:21:15,199
this integrated system so it's this

2151
01:21:20,149 --> 01:21:17,760
perspective from space that gives us

2152
01:21:23,669 --> 01:21:20,159
this opportunity to study

2153
01:21:26,629 --> 01:21:23,679
how our planet has changed in the past

2154
01:21:28,709 --> 01:21:26,639
how it's changing right now and how it

2155
01:21:31,470 --> 01:21:28,719
may change in the future

2156
01:21:35,270 --> 01:21:31,480
now this science goes back to the early

2157
01:21:37,590 --> 01:21:35,280
1960s with the first weather satellites

2158
01:21:39,750 --> 01:21:37,600
but the field has really

2159
01:21:42,229 --> 01:21:39,760
gone much further beyond just

2160
01:21:45,270 --> 01:21:42,239
meteorology to the broader atmospheric

2161
01:21:49,270 --> 01:21:45,280
sciences and observations of atmospheric

2162
01:21:50,709 --> 01:21:49,280
chemistry and aerosols to oceanography

2163
01:21:53,350 --> 01:21:50,719

hydrology

2164
01:21:55,030 --> 01:21:53,360
cryospheric processes

2165
01:21:57,350 --> 01:21:55,040
observations and understanding of

2166
01:22:00,470 --> 01:21:57,360
terrestrial ecosystems and marine

2167
01:22:02,870 --> 01:22:00,480
ecosystems so we are now able to look

2168
01:22:06,070 --> 01:22:02,880
literally at the heartbeats of the

2169
01:22:07,350 --> 01:22:06,080
planet on time scales from days to

2170
01:22:09,590 --> 01:22:07,360
decades

2171
01:22:11,910 --> 01:22:09,600
the pulsing of life on the planet on

2172
01:22:15,430 --> 01:22:11,920
these time scales and now using that

2173
01:22:17,510 --> 01:22:15,440
information to diagnose the planet we're

2174
01:22:19,270 --> 01:22:17,520
living on and

2175
01:22:22,310 --> 01:22:19,280
where things are changing where are the

2176
01:22:25,030 --> 01:22:22,320
anomalies why are those anomalies there

2177
01:22:26,629 --> 01:22:25,040
and then what does it portend for

2178
01:22:29,910 --> 01:22:26,639
the future

2179
01:22:32,550 --> 01:22:29,920
of our species on this planet and how we

2180
01:22:34,070 --> 01:22:32,560
can use this information not just for

2181
01:22:36,310 --> 01:22:34,080
science

2182
01:22:37,430 --> 01:22:36,320
but for the protection of life and

2183
01:22:41,510 --> 01:22:37,440
property

2184
01:22:44,229 --> 01:22:41,520
to inform policy decisions to make wise

2185
01:22:46,470 --> 01:22:44,239
investment decisions and also in support

2186
01:22:48,790 --> 01:22:46,480
of national security where

2187
01:22:51,990 --> 01:22:48,800
environmental perturbations around the

2188
01:22:53,110 --> 01:22:52,000

world are often a threat multiplier to

2189
01:22:55,110 --> 01:22:53,120
existing

2190
01:22:58,470 --> 01:22:55,120
problems as we've seen for example

2191
01:23:00,629 --> 01:22:58,480
recently in somalia so this whole field

2192
01:23:03,110 --> 01:23:00,639
of earth system science goes back again

2193
01:23:05,510 --> 01:23:03,120
as i said the beginning to

2194
01:23:06,950 --> 01:23:05,520
what was known in the 80s and 90s as

2195
01:23:10,470 --> 01:23:06,960
mission to planet earth that then

2196
01:23:12,229 --> 01:23:10,480
evolved into the earth observing system

2197
01:23:14,070 --> 01:23:12,239
and eos

2198
01:23:16,629 --> 01:23:14,080
as it's known

2199
01:23:19,430 --> 01:23:16,639
i would argue was

2200
01:23:21,750 --> 01:23:19,440
a successful very successful proof of

2201
01:23:23,270 --> 01:23:21,760
concept and it was a proof

2202
01:23:26,149 --> 01:23:23,280
of concept

2203
01:23:28,950 --> 01:23:26,159
and one of the pressing questions is

2204
01:23:29,910 --> 01:23:28,960
what will be its legacy

2205
01:23:33,270 --> 01:23:29,920
will

2206
01:23:35,910 --> 01:23:33,280
this approach to monitoring the earth as

2207
01:23:38,950 --> 01:23:35,920
a system

2208
01:23:40,310 --> 01:23:38,960
succumb or be a victim of its own

2209
01:23:43,270 --> 01:23:40,320
success

2210
01:23:44,550 --> 01:23:43,280
or will it be a trailblazer to the

2211
01:23:46,149 --> 01:23:44,560
future

2212
01:23:47,990 --> 01:23:46,159
in support of all those different

2213
01:23:52,629 --> 01:23:48,000

sectors and i hope we can develop and

2214
01:23:55,590 --> 01:23:53,990
just one short comment one of the things

2215
01:23:57,189 --> 01:23:55,600
that i'm able to do at goddard is often

2216
01:23:59,270 --> 01:23:57,199
talk to embassy staff from all over the

2217
01:24:00,950 --> 01:23:59,280
world as well as congressional visits

2218
01:24:02,550 --> 01:24:00,960
that come to goddard and the idea that

2219
01:24:04,870 --> 01:24:02,560
nasa is a world treasure when it comes

2220
01:24:07,030 --> 01:24:04,880
to earth science yes as tony was talking

2221
01:24:08,470 --> 01:24:07,040
the just the the breadth of ways that we

2222
01:24:10,870 --> 01:24:08,480
observe the earth everything from

2223
01:24:12,070 --> 01:24:10,880
disaster relief uh the gravity recovery

2224
01:24:14,550 --> 01:24:12,080
and climate experiment was able to

2225
01:24:16,790 --> 01:24:14,560
record crustal shifting under fukushima

2226
01:24:18,709 --> 01:24:16,800
after the earthquake and tsunami

2227
01:24:21,110 --> 01:24:18,719
we are a world treasurer this data is

2228
01:24:23,990 --> 01:24:21,120
available to any nation's government any

2229
01:24:25,830 --> 01:24:24,000
person on the planet for free

2230
01:24:28,709 --> 01:24:25,840
this is something that our nation needs

2231
01:24:30,470 --> 01:24:28,719
to be extremely proud of

2232
01:24:32,310 --> 01:24:30,480
there is nobody else providing this

2233
01:24:34,550 --> 01:24:32,320
service right now and it is the most

2234
01:24:35,990 --> 01:24:34,560
important time perhaps in human history

2235
01:24:37,270 --> 01:24:36,000
for us to be monitoring what the earth

2236
01:24:38,950 --> 01:24:37,280
is doing

2237
01:24:40,870 --> 01:24:38,960
now i don't think it was deliberate but

2238
01:24:43,189 --> 01:24:40,880

uh tony is actually a bit of a nasa

2239
01:24:44,470 --> 01:24:43,199
person and noah person and so we have

2240
01:24:46,390 --> 01:24:44,480
sort of nasa on this side and we're

2241
01:24:47,270 --> 01:24:46,400
going to end then with with noah so

2242
01:24:49,510 --> 01:24:47,280
please

2243
01:24:51,270 --> 01:24:49,520
all right thank you michelle uh i'm dave

2244
01:24:52,709 --> 01:24:51,280
novak and i'm coming to you from the

2245
01:24:53,830 --> 01:24:52,719
national weather

2246
01:24:55,590 --> 01:24:53,840
service

2247
01:24:57,669 --> 01:24:55,600
we provide the nation's fundamental

2248
01:24:59,510 --> 01:24:57,679
weather and water information to save

2249
01:25:01,189 --> 01:24:59,520
life and property and enhance the

2250
01:25:03,270 --> 01:25:01,199
economy

2251
01:25:05,350 --> 01:25:03,280
i'm in a sub-agency of the national

2252
01:25:07,189 --> 01:25:05,360
weather service the national centers for

2253
01:25:08,550 --> 01:25:07,199
environmental prediction

2254
01:25:10,149 --> 01:25:08,560
and you may have heard of the national

2255
01:25:12,149 --> 01:25:10,159
hurricane center or the storms

2256
01:25:13,910 --> 01:25:12,159
prediction center i'm located in the

2257
01:25:16,470 --> 01:25:13,920
hydro meteorological prediction center

2258
01:25:18,390 --> 01:25:16,480
where our focus is on heavy rainfall and

2259
01:25:19,669 --> 01:25:18,400
heavy snowstorms as well as extended

2260
01:25:21,350 --> 01:25:19,679
forecasts

2261
01:25:24,149 --> 01:25:21,360
i want to mention

2262
01:25:27,030 --> 01:25:24,159
some key partnerships nasa has been

2263
01:25:29,830 --> 01:25:27,040

critical to the weather enterprise in

2264
01:25:31,510 --> 01:25:29,840
terms of advancing our science it

2265
01:25:35,590 --> 01:25:31,520
weather and meteorology is really an

2266
01:25:37,270 --> 01:25:35,600
application of some of the nasa science

2267
01:25:39,030 --> 01:25:37,280
certainly our first view of earth from

2268
01:25:41,030 --> 01:25:39,040
space was revealing to us from

2269
01:25:43,270 --> 01:25:41,040
meteorologists as we could see these

2270
01:25:45,110 --> 01:25:43,280
weather systems as they move and in

2271
01:25:47,830 --> 01:25:45,120
their entirety

2272
01:25:49,830 --> 01:25:47,840
so we're really excited to be moving to

2273
01:25:52,870 --> 01:25:49,840
our new location just a stone's throw

2274
01:25:55,030 --> 01:25:52,880
away here at the m square research park

2275
01:25:56,629 --> 01:25:55,040
where we'll be in closer connection with

2276
01:25:58,550 --> 01:25:56,639
the research community such as here at

2277
01:26:01,030 --> 01:25:58,560
university of maryland as well as nasa

2278
01:26:03,590 --> 01:26:01,040
goddard to really take advantage of some

2279
01:26:06,550 --> 01:26:03,600
of the nasa science as well as what the

2280
01:26:08,629 --> 01:26:06,560
academic community is doing

2281
01:26:10,149 --> 01:26:08,639
now one of the questions

2282
01:26:12,629 --> 01:26:10,159
michelle had

2283
01:26:14,870 --> 01:26:12,639
challenged us with is why does your

2284
01:26:17,110 --> 01:26:14,880
science discipline matter

2285
01:26:19,189 --> 01:26:17,120
and if i could have a show of hands here

2286
01:26:24,310 --> 01:26:19,199
how many of you either heard

2287
01:26:27,750 --> 01:26:25,189
right

2288
01:26:28,950 --> 01:26:27,760

i mean weather is pervasive in our

2289
01:26:31,270 --> 01:26:28,960
society

2290
01:26:32,229 --> 01:26:31,280
in fact a recent estimate

2291
01:26:35,030 --> 01:26:32,239
has

2292
01:26:37,590 --> 01:26:35,040
noted that among america's weather

2293
01:26:40,470 --> 01:26:37,600
industries about a half a trillion

2294
01:26:43,110 --> 01:26:40,480
dollars is sensitive to even mundane

2295
01:26:45,110 --> 01:26:43,120
weather events rainfall snowfall cooler

2296
01:26:46,550 --> 01:26:45,120
than average warmer than average

2297
01:26:48,310 --> 01:26:46,560
and then if you turn attention to

2298
01:26:50,390 --> 01:26:48,320
extreme weather events which we've

2299
01:26:52,229 --> 01:26:50,400
certainly seen many this year ranging

2300
01:26:53,750 --> 01:26:52,239
from floods to droughts tornadoes

2301
01:26:56,550 --> 01:26:53,760
hurricanes

2302
01:26:57,590 --> 01:26:56,560
you really see the the incredible loss

2303
01:27:00,149 --> 01:26:57,600
of life

2304
01:27:01,669 --> 01:27:00,159
as well as threats to the economy from

2305
01:27:04,629 --> 01:27:01,679
these weather systems

2306
01:27:07,030 --> 01:27:04,639
and so as a scientist being able to see

2307
01:27:08,629 --> 01:27:07,040
how science is applied in a very

2308
01:27:11,750 --> 01:27:08,639
practical way

2309
01:27:14,629 --> 01:27:11,760
to make weather forecasts that impact

2310
01:27:16,870 --> 01:27:14,639
everyone in this room save lives

2311
01:27:20,629 --> 01:27:16,880
enhance the economy is really

2312
01:27:22,790 --> 01:27:20,639
inspirational and uh and rewarding

2313
01:27:25,990 --> 01:27:22,800

now you've probably heard many weather

2314
01:27:27,990 --> 01:27:26,000
jokes and i have of course myself

2315
01:27:31,270 --> 01:27:28,000
uh for example uh you know we're the

2316
01:27:34,149 --> 01:27:31,280
only profession to get paid to be ron

2317
01:27:37,030 --> 01:27:34,159
um but if you think back from where

2318
01:27:39,110 --> 01:27:37,040
we've come from uh here in the dc area

2319
01:27:40,550 --> 01:27:39,120
of course a snowstorm can be crippling

2320
01:27:43,590 --> 01:27:40,560
if you think back to your childhood

2321
01:27:45,590 --> 01:27:43,600
forecast of a snowstorm here in the dc

2322
01:27:48,470 --> 01:27:45,600
area and you compare that to the

2323
01:27:51,270 --> 01:27:48,480
forecast you're receiving today

2324
01:27:53,910 --> 01:27:51,280
airlines are canceling flights two days

2325
01:27:55,510 --> 01:27:53,920
in advance it's sunny it's calm

2326
01:27:57,990 --> 01:27:55,520
but they're cancelling flights on

2327
01:27:59,430 --> 01:27:58,000
forecasts that noaa is providing and the

2328
01:28:02,310 --> 01:27:59,440
event happens

2329
01:28:03,990 --> 01:28:02,320
and so this is uh really um

2330
01:28:08,709 --> 01:28:04,000
for for the entire scientific community

2331
01:28:11,430 --> 01:28:08,719
this is really a uh an accomplishment

2332
01:28:13,590 --> 01:28:11,440
of course uh we have a long way to go

2333
01:28:15,030 --> 01:28:13,600
there's no question about that

2334
01:28:16,790 --> 01:28:15,040
and so the national weather service

2335
01:28:19,189 --> 01:28:16,800
recently came out with our strategic

2336
01:28:22,229 --> 01:28:19,199
plan for 2020

2337
01:28:24,070 --> 01:28:22,239
and in this plan our goal is to make

2338
01:28:27,270 --> 01:28:24,080

the nation weather

2339
01:28:30,149 --> 01:28:27,280
ready building a weather ready nation

2340
01:28:32,470 --> 01:28:30,159
now a key component of this is

2341
01:28:34,470 --> 01:28:32,480
building upon the science and technology

2342
01:28:36,070 --> 01:28:34,480
that we have to make our forecast even

2343
01:28:37,350 --> 01:28:36,080
more accurate than what they currently

2344
01:28:39,830 --> 01:28:37,360
are

2345
01:28:42,629 --> 01:28:39,840
but we've recognized that just making a

2346
01:28:44,790 --> 01:28:42,639
good forecast it's not enough as we've

2347
01:28:47,590 --> 01:28:44,800
seen with a number of extreme events

2348
01:28:50,149 --> 01:28:47,600
you have to have individuals take action

2349
01:28:52,709 --> 01:28:50,159
they have to understand the message

2350
01:28:54,870 --> 01:28:52,719
understand the scientific information

2351
01:28:57,189 --> 01:28:54,880
that they're that they're receiving so

2352
01:28:59,910 --> 01:28:57,199
it's communication it's a

2353
01:29:03,350 --> 01:28:59,920
sociology and a behavioral science issue

2354
01:29:05,669 --> 01:29:03,360
so it involves interdisciplinary science

2355
01:29:07,030 --> 01:29:05,679
aspects that noaa and the national

2356
01:29:07,990 --> 01:29:07,040
weather service are certainly getting

2357
01:29:09,430 --> 01:29:08,000
into

2358
01:29:11,750 --> 01:29:09,440
and i'll just briefly mention another

2359
01:29:13,430 --> 01:29:11,760
aspect of that plan is the recognition

2360
01:29:15,750 --> 01:29:13,440
of the need to include include

2361
01:29:18,229 --> 01:29:15,760
confidence in our forecast

2362
01:29:21,110 --> 01:29:18,239
to recognize that the

2363
01:29:22,629 --> 01:29:21,120

the earth system is incredibly complex

2364
01:29:25,270 --> 01:29:22,639
it's chaotic

2365
01:29:27,110 --> 01:29:25,280
and that there is uncertainty in in our

2366
01:29:28,790 --> 01:29:27,120
forecasts and projections that go out

2367
01:29:30,950 --> 01:29:28,800
and to acknowledge that and to actually

2368
01:29:32,870 --> 01:29:30,960
build that into our decisions

2369
01:29:34,870 --> 01:29:32,880
so finally i just want to close that you

2370
01:29:36,950 --> 01:29:34,880
know we all recognize it's a very tough

2371
01:29:38,550 --> 01:29:36,960
uh budget environment

2372
01:29:40,870 --> 01:29:38,560
and yet the need for environmental

2373
01:29:42,310 --> 01:29:40,880
information is rapidly growing

2374
01:29:44,070 --> 01:29:42,320
so i think the challenge as we look

2375
01:29:46,870 --> 01:29:44,080
towards the future here

2376
01:29:50,629 --> 01:29:46,880
is we know that it's even more important

2377
01:29:52,629 --> 01:29:50,639
for new technology new science and new

2378
01:29:54,950 --> 01:29:52,639
innovative ways of thinking about how we

2379
01:29:56,870 --> 01:29:54,960
can tie science and technology together

2380
01:29:57,910 --> 01:29:56,880
to address these critical environmental

2381
01:30:00,390 --> 01:29:57,920
issues

2382
01:30:01,990 --> 01:30:00,400
as we are budget constrained

2383
01:30:04,550 --> 01:30:02,000
so i look forward to your questions as

2384
01:30:06,390 --> 01:30:04,560
we continue to think about the future

2385
01:30:07,750 --> 01:30:06,400
well thank you i i we already are

2386
01:30:09,189 --> 01:30:07,760
getting some questions from twitter but

2387
01:30:10,470 --> 01:30:09,199
i want to make sure we also i'm happy to

2388
01:30:12,790 --> 01:30:10,480

get to those i'd like to give people a

2389
01:30:14,470 --> 01:30:12,800
chance here we have a wide range of

2390
01:30:16,149 --> 01:30:14,480
panelists i mean i can think of a few

2391
01:30:17,990 --> 01:30:16,159
questions i want to ask everybody but

2392
01:30:19,590 --> 01:30:18,000
maybe we should should we open it up or

2393
01:30:21,030 --> 01:30:19,600
shall i start with the twitter i was

2394
01:30:22,550 --> 01:30:21,040
just going to invite folks here in the

2395
01:30:25,189 --> 01:30:22,560
room to come up to the microphones if

2396
01:30:26,790 --> 01:30:25,199
you have questions for our panels uh

2397
01:30:28,070 --> 01:30:26,800
we have microphones here in the aisles

2398
01:30:30,709 --> 01:30:28,080
if you'd like to come up and ask a

2399
01:30:32,470 --> 01:30:30,719
question for anyone on the panel

2400
01:30:33,430 --> 01:30:32,480
we also do have some questions from

2401
01:30:35,189 --> 01:30:33,440
twitter

2402
01:30:36,790 --> 01:30:35,199
so if you want to start out with those

2403
01:30:38,390 --> 01:30:36,800
we can and if you

2404
01:30:39,750 --> 01:30:38,400
want to come up to the mics

2405
01:30:42,629 --> 01:30:39,760
why don't we start with one here at the

2406
01:30:43,990 --> 01:30:42,639
microphone and go to twitter sir yes hi

2407
01:30:45,990 --> 01:30:44,000
i'm greg shuckerman from the university

2408
01:30:48,310 --> 01:30:46,000
of central florida i'm reminded of a

2409
01:30:49,750 --> 01:30:48,320
quote by a member of congress saying why

2410
01:30:50,629 --> 01:30:49,760
do we need

2411
01:30:52,310 --> 01:30:50,639
uh

2412
01:30:53,750 --> 01:30:52,320
nasa and noah to do the weather

2413
01:30:54,790 --> 01:30:53,760

monitoring because we have the weather

2414
01:30:56,709 --> 01:30:54,800
channel

2415
01:30:59,189 --> 01:30:56,719
you know i have heard this i i it is

2416
01:31:01,590 --> 01:30:59,199
such a brilliant quote does anybody know

2417
01:31:05,430 --> 01:31:01,600
who said that i i don't think they're

2418
01:31:09,830 --> 01:31:08,070
so um the question really isn't by the

2419
01:31:11,510 --> 01:31:09,840
way thank you for the panel it's it's

2420
01:31:13,030 --> 01:31:11,520
really wonderful and inspiring and i

2421
01:31:14,470 --> 01:31:13,040
have a nine-year-old son at home that

2422
01:31:15,590 --> 01:31:14,480
would have loved to hear all this

2423
01:31:17,590 --> 01:31:15,600
because he's

2424
01:31:20,229 --> 01:31:17,600
he is very inspired by the work that

2425
01:31:22,550 --> 01:31:20,239
you're doing and talking about

2426
01:31:24,390 --> 01:31:22,560
there was a gao report not too long ago

2427
01:31:27,189 --> 01:31:24,400
that talked about

2428
01:31:29,110 --> 01:31:27,199
duplication of programs and so i'm

2429
01:31:30,629 --> 01:31:29,120
thinking about the programs that you

2430
01:31:34,629 --> 01:31:30,639
have at nasa the programs that you have

2431
01:31:36,229 --> 01:31:34,639
at noaa usgs has a program as well that

2432
01:31:38,870 --> 01:31:36,239
helps inform when you're talking about

2433
01:31:41,910 --> 01:31:38,880
flights and and volcanic eruptions and

2434
01:31:43,590 --> 01:31:41,920
how that disrupts uh schedules so i was

2435
01:31:45,189 --> 01:31:43,600
just wondering

2436
01:31:47,030 --> 01:31:45,199
because i do support the work that

2437
01:31:48,629 --> 01:31:47,040
you're doing and i think it is vitally

2438
01:31:52,470 --> 01:31:48,639

important but it

2439
01:31:54,709 --> 01:31:52,480
is there an opportunity to perhaps

2440
01:31:56,390 --> 01:31:54,719
consolidate coordinate better between

2441
01:31:58,550 --> 01:31:56,400
the agencies so that there isn't the

2442
01:32:01,830 --> 01:31:58,560
criticisms that are lobbed about

2443
01:32:07,510 --> 01:32:05,110
so the answer is yes and actually ostp

2444
01:32:08,709 --> 01:32:07,520
is working on that right now

2445
01:32:11,110 --> 01:32:08,719
there are

2446
01:32:13,510 --> 01:32:11,120
there's a stack of academy documents

2447
01:32:15,189 --> 01:32:13,520
that are calling for as in the gao

2448
01:32:19,110 --> 01:32:15,199
report

2449
01:32:22,229 --> 01:32:19,120
that we sorely need a national strategy

2450
01:32:24,229 --> 01:32:22,239
for sustained space-based observations

2451
01:32:27,470 --> 01:32:24,239
of the planet we live on that's

2452
01:32:31,189 --> 01:32:27,480
inclusive of this uh aspect of roles and

2453
01:32:34,950 --> 01:32:31,199
responsibilities across the agencies

2454
01:32:38,390 --> 01:32:34,960
um dealing with issues of cost growth

2455
01:32:40,550 --> 01:32:38,400
mission creep access to space so osp is

2456
01:32:42,950 --> 01:32:40,560
working on that right now

2457
01:32:44,310 --> 01:32:42,960
and i'll also be a little bit parochial

2458
01:32:46,790 --> 01:32:44,320
david alluded to it here at the

2459
01:32:49,110 --> 01:32:46,800
university of maryland uh with noah

2460
01:32:50,229 --> 01:32:49,120
moving on to campus with 800 plus civil

2461
01:32:52,470 --> 01:32:50,239
servants

2462
01:32:55,030 --> 01:32:52,480
with goddard down the road we have

2463
01:32:56,950 --> 01:32:55,040

arguably the largest collection of earth

2464
01:32:59,750 --> 01:32:56,960
scientists in this five mile radius

2465
01:33:01,510 --> 01:32:59,760
anywhere in the world that means we have

2466
01:33:03,990 --> 01:33:01,520
the responsibility we have the

2467
01:33:06,709 --> 01:33:04,000
responsibility to help take on this

2468
01:33:08,390 --> 01:33:06,719
problem and provide some solutions so

2469
01:33:11,110 --> 01:33:08,400
i'm actually not very sanguine in the

2470
01:33:13,669 --> 01:33:11,120
mid term about this but in the long term

2471
01:33:16,149 --> 01:33:13,679
i'm extremely optimistic that

2472
01:33:19,270 --> 01:33:16,159
with the talent here and the agencies

2473
01:33:20,790 --> 01:33:19,280
here we are going to tackle this problem

2474
01:33:22,229 --> 01:33:20,800
and sustain these observations in the

2475
01:33:23,430 --> 01:33:22,239
long term and you know a lot of us are

2476
01:33:25,590 --> 01:33:23,440
very anxious

2477
01:33:28,390 --> 01:33:25,600
to see what ostp comes up with

2478
01:33:31,910 --> 01:33:28,400
yeah i'd also like to add i i fully

2479
01:33:33,910 --> 01:33:31,920
agree with everything tony said um

2480
01:33:36,709 --> 01:33:33,920
there's one thing to add to that though

2481
01:33:38,149 --> 01:33:36,719
is i think some of that perception

2482
01:33:40,790 --> 01:33:38,159
is is

2483
01:33:41,990 --> 01:33:40,800
a result of not being fully informed in

2484
01:33:44,470 --> 01:33:42,000
what the current roles and

2485
01:33:46,310 --> 01:33:44,480
responsibilities of each organization

2486
01:33:48,709 --> 01:33:46,320
are they certainly

2487
01:33:51,750 --> 01:33:48,719
there are certainly room i think for for

2488
01:33:54,790 --> 01:33:51,760

optimization but at the same time i

2489
01:33:57,350 --> 01:33:54,800
don't think there's as much redundancy

2490
01:33:59,030 --> 01:33:57,360
as some people may think because

2491
01:34:01,430 --> 01:33:59,040
you know nasa is a research and

2492
01:34:03,189 --> 01:34:01,440
development organization we we figure

2493
01:34:05,669 --> 01:34:03,199
out how to do it

2494
01:34:07,270 --> 01:34:05,679
uh noah takes that capability and turns

2495
01:34:09,590 --> 01:34:07,280
that into useful and actionable

2496
01:34:11,830 --> 01:34:09,600
information so there are there are

2497
01:34:14,149 --> 01:34:11,840
clear roles and responsibilities and

2498
01:34:16,470 --> 01:34:14,159
it's natural that there'd be not just a

2499
01:34:19,189 --> 01:34:16,480
perfect butting up but but in fact a

2500
01:34:21,270 --> 01:34:19,199
little bit of overlap so what ostp is

2501
01:34:24,149 --> 01:34:21,280
doing and those involved is trying to

2502
01:34:26,470 --> 01:34:24,159
find the optimum i mean i would just add

2503
01:34:28,790 --> 01:34:26,480
i mean i fully well he said it's not the

2504
01:34:30,390 --> 01:34:28,800
redundancy issue is as much as

2505
01:34:32,229 --> 01:34:30,400
how do we sustain

2506
01:34:33,910 --> 01:34:32,239
the enterprise how do we do how do we

2507
01:34:36,229 --> 01:34:33,920
cross the valley of death how do we make

2508
01:34:37,830 --> 01:34:36,239
the transition from research to

2509
01:34:39,990 --> 01:34:37,840
operations but here because this is a

2510
01:34:42,870 --> 01:34:40,000
critical difference from space science

2511
01:34:46,390 --> 01:34:42,880
we're talking about long-term sustained

2512
01:34:48,390 --> 01:34:46,400
observations how do we insert technology

2513
01:34:50,550 --> 01:34:48,400

how do we have stable and continuous

2514
01:34:52,950 --> 01:34:50,560
observations so it's not just discovery

2515
01:34:55,189 --> 01:34:52,960
unto itself but then it's going into the

2516
01:34:57,270 --> 01:34:55,199
operational phase and how do you do that

2517
01:34:59,990 --> 01:34:57,280
where it's affordable that's all part

2518
01:35:02,149 --> 01:35:00,000
and parcel of developing the strategy

2519
01:35:03,669 --> 01:35:02,159
and less about the redundancies and how

2520
01:35:05,270 --> 01:35:03,679
do you make this affordable and

2521
01:35:06,790 --> 01:35:05,280
sustainable

2522
01:35:08,629 --> 01:35:06,800
and i'll just briefly mention that i

2523
01:35:11,990 --> 01:35:08,639
think the degree of collaboration

2524
01:35:15,030 --> 01:35:12,000
amongst the federal agencies uh is is

2525
01:35:17,109 --> 01:35:15,040
really uh you know at a high right now

2526
01:35:19,430 --> 01:35:17,119
you know uh so i think there's already

2527
01:35:22,790 --> 01:35:19,440
been positive movement in that regard

2528
01:35:25,990 --> 01:35:24,229
would you like to go to the twitter

2529
01:35:27,590 --> 01:35:26,000
question all right so um i think this

2530
01:35:29,590 --> 01:35:27,600
this will definitely uh uh i'll probably

2531
01:35:31,590 --> 01:35:29,600
shoot this too to matt first and walid

2532
01:35:33,350 --> 01:35:31,600
as well uh as matt mentioned i think you

2533
01:35:35,510 --> 01:35:33,360
set us up for the fact that jwst has

2534
01:35:37,270 --> 01:35:35,520
been in the news a lot lately and uh and

2535
01:35:38,629 --> 01:35:37,280
so uh the the uh we have actually a

2536
01:35:41,270 --> 01:35:38,639
number of people that have asked what is

2537
01:35:43,510 --> 01:35:41,280
the status of jwst and uh the follow-up

2538
01:35:45,750 --> 01:35:43,520

is what is at stake if it is cancelled

2539
01:35:47,910 --> 01:35:45,760
i'm sorry what is at stake if it is

2540
01:35:53,189 --> 01:35:47,920
cancelled

2541
01:35:55,510 --> 01:35:53,199
space science is at stake because it is

2542
01:35:57,990 --> 01:35:55,520
the pinnacle of what everybody wanted to

2543
01:35:59,270 --> 01:35:58,000
do for two decades surveys you know when

2544
01:36:00,709 --> 01:35:59,280
you look at what the hubble has done the

2545
01:36:02,390 --> 01:36:00,719
other space telescopes have done what

2546
01:36:03,830 --> 01:36:02,400
they do on the ground the fundamental

2547
01:36:06,229 --> 01:36:03,840
questions you want to ask is what were

2548
01:36:08,070 --> 01:36:06,239
the first galaxies is the water in other

2549
01:36:09,430 --> 01:36:08,080
planets there's only one way to do that

2550
01:36:11,910 --> 01:36:09,440
and that's with the telescope of that

2551
01:36:14,229 --> 01:36:11,920
scale and it was an investment that nasa

2552
01:36:15,830 --> 01:36:14,239
is making and needs to make if

2553
01:36:17,510 --> 01:36:15,840
uh we ever

2554
01:36:19,189 --> 01:36:17,520
want to answer those kind of profound

2555
01:36:21,350 --> 01:36:19,199
questions you know it's the success of

2556
01:36:23,830 --> 01:36:21,360
the hubble space telescope it's there's

2557
01:36:25,350 --> 01:36:23,840
a generation out there that grew up with

2558
01:36:27,189 --> 01:36:25,360
the hubble space telescope and want to

2559
01:36:29,109 --> 01:36:27,199
know where's their hubble this is hubble

2560
01:36:31,990 --> 01:36:29,119
2.0

2561
01:36:33,910 --> 01:36:32,000
you know we touch 10 000 astronomers

2562
01:36:36,070 --> 01:36:33,920
6 million kids a year with our hubble

2563
01:36:38,470 --> 01:36:36,080

programs we've got to sustain that

2564
01:36:40,149 --> 01:36:38,480
engagement and excitement

2565
01:36:42,390 --> 01:36:40,159
not just from a scientific perspective

2566
01:36:44,149 --> 01:36:42,400
but from an inspirational perspective

2567
01:36:46,229 --> 01:36:44,159
and the important part of this is to

2568
01:36:48,709 --> 01:36:46,239
realize that the james webb is just a

2569
01:36:50,470 --> 01:36:48,719
stepping stone to a much grander quest

2570
01:36:52,229 --> 01:36:50,480
of are we alone

2571
01:36:54,390 --> 01:36:52,239
what other technologies will we need

2572
01:36:57,350 --> 01:36:54,400
over the course of the next 10 20 30

2573
01:37:00,470 --> 01:36:57,360
years to be that generation for the

2574
01:37:03,270 --> 01:37:00,480
first time in our hist species history

2575
01:37:05,270 --> 01:37:03,280
to answer the question are we alone and

2576
01:37:07,590 --> 01:37:05,280
how do you inspire people to actually

2577
01:37:10,070 --> 01:37:07,600
get into technology into science you

2578
01:37:12,629 --> 01:37:10,080
give them important questions that only

2579
01:37:14,470 --> 01:37:12,639
they think they can answer how to build

2580
01:37:16,149 --> 01:37:14,480
these amazing telescopes or construct

2581
01:37:17,590 --> 01:37:16,159
them in ways that we could only have

2582
01:37:20,470 --> 01:37:17,600
imagined

2583
01:37:22,790 --> 01:37:20,480
think back to lyman spitzer in 1946

2584
01:37:25,510 --> 01:37:22,800
saying i think i need a telescope in

2585
01:37:26,709 --> 01:37:25,520
space if he hadn't asked that question

2586
01:37:28,070 --> 01:37:26,719
we wouldn't have had the hubble we

2587
01:37:30,709 --> 01:37:28,080
wouldn't have had the

2588
01:37:32,550 --> 01:37:30,719

profound change in our world view that

2589
01:37:34,629 --> 01:37:32,560
has come about from putting telescopes

2590
01:37:37,030 --> 01:37:34,639
in space

2591
01:37:39,270 --> 01:37:37,040
i actually think i'll leave it at that

2592
01:37:41,350 --> 01:37:39,280
very powerful um

2593
01:37:43,430 --> 01:37:41,360
enough said i know some of the inspiring

2594
01:37:45,990 --> 01:37:43,440
things that i've heard from you ali

2595
01:37:47,430 --> 01:37:46,000
do actually get at the at the heart of

2596
01:37:48,870 --> 01:37:47,440
you know how expensive is this you know

2597
01:37:50,950 --> 01:37:48,880
how much of an investment is this for a

2598
01:37:52,870 --> 01:37:50,960
nation and and just you know isn't this

2599
01:37:54,229 --> 01:37:52,880
an incredibly cost-effective thing to do

2600
01:37:55,430 --> 01:37:54,239
for the discovery that's going to come

2601
01:37:58,310 --> 01:37:55,440
out

2602
01:38:00,550 --> 01:37:58,320
absolutely and i think um you know with

2603
01:38:04,149 --> 01:38:00,560
all the amazing discoveries that hubble

2604
01:38:08,390 --> 01:38:05,350
we forget

2605
01:38:10,390 --> 01:38:08,400
what it cost what it overran

2606
01:38:12,629 --> 01:38:10,400
the fact that

2607
01:38:15,430 --> 01:38:12,639
the polishing of the mirrors left us

2608
01:38:17,910 --> 01:38:15,440
with a bit of a problem that needed

2609
01:38:20,070 --> 01:38:17,920
heroic repairs that really showed i

2610
01:38:22,070 --> 01:38:20,080
think the best of human space flight and

2611
01:38:22,870 --> 01:38:22,080
science working together

2612
01:38:24,229 --> 01:38:22,880
we

2613
01:38:27,109 --> 01:38:24,239

forget that

2614
01:38:29,750 --> 01:38:27,119
and we think about the amazing things it

2615
01:38:32,149 --> 01:38:29,760
does the children it's touch the adults

2616
01:38:34,229 --> 01:38:32,159
it's touched the spirit

2617
01:38:36,390 --> 01:38:34,239
deep inside us that

2618
01:38:39,430 --> 01:38:36,400
images of the various nebulae for

2619
01:38:41,350 --> 01:38:39,440
example awaken you cannot

2620
01:38:42,149 --> 01:38:41,360
put a price on that

2621
01:38:44,709 --> 01:38:42,159
and

2622
01:38:46,629 --> 01:38:44,719
even if you could you'd have to add to

2623
01:38:49,030 --> 01:38:46,639
that the value that comes with the

2624
01:38:51,669 --> 01:38:49,040
technological advances leadership in the

2625
01:38:54,229 --> 01:38:51,679
world in this in this particular area

2626
01:38:56,149 --> 01:38:54,239
the kinds of jobs it created how many

2627
01:38:59,189 --> 01:38:56,159
states have businesses that that

2628
01:39:02,550 --> 01:38:59,199
contribute to contributed to hubble that

2629
01:39:04,790 --> 01:39:02,560
are contributing to jwst so it it you

2630
01:39:06,470 --> 01:39:04,800
know on multiple fronts

2631
01:39:08,390 --> 01:39:06,480
it is a

2632
01:39:10,550 --> 01:39:08,400
wonderful pursuit

2633
01:39:12,310 --> 01:39:10,560
worthy of the challenge you know worthy

2634
01:39:13,350 --> 01:39:12,320
of overcoming the challenges that we

2635
01:39:14,709 --> 01:39:13,360
face

2636
01:39:16,229 --> 01:39:14,719
whenever i'm feeling a little bit down

2637
01:39:17,590 --> 01:39:16,239
about the status of jwst and the

2638
01:39:19,350 --> 01:39:17,600

arguments there's actually a youtube

2639
01:39:21,350 --> 01:39:19,360
video that has nothing to do with nasa

2640
01:39:23,910 --> 01:39:21,360
entirely independent if you do a youtube

2641
01:39:25,510 --> 01:39:23,920
search on jwst awesome

2642
01:39:27,350 --> 01:39:25,520
if it doesn't make you laugh you should

2643
01:39:29,590 --> 01:39:27,360
check your pulse i think it's a

2644
01:39:32,070 --> 01:39:29,600
wonderful video done by some independent

2645
01:39:33,189 --> 01:39:32,080
people and and just the the i think they

2646
01:39:36,070 --> 01:39:33,199
really get to the heart of some of the

2647
01:39:38,550 --> 01:39:36,080
exciting issues about jwst i notice we

2648
01:39:40,790 --> 01:39:38,560
have a question in the audience

2649
01:39:41,910 --> 01:39:40,800
yeah hi my name is taylor hamilton i'm a

2650
01:39:43,669 --> 01:39:41,920
student here at university of maryland

2651
01:39:44,550 --> 01:39:43,679
it's kind of a follow-up to the previous

2652
01:39:47,030 --> 01:39:44,560
question

2653
01:39:49,109 --> 01:39:47,040
you talked about how inspirational the

2654
01:39:50,149 --> 01:39:49,119
hubble space telescope has been

2655
01:39:52,790 --> 01:39:50,159
how

2656
01:39:55,189 --> 01:39:52,800
can nasa get the general public excited

2657
01:39:58,149 --> 01:39:55,199
for the james webb space telescope

2658
01:39:59,430 --> 01:39:58,159
well what is quite interesting is that i

2659
01:40:01,189 --> 01:39:59,440
i give talks around the country about

2660
01:40:03,910 --> 01:40:01,199
hubble and so forth and i put in maybe a

2661
01:40:05,750 --> 01:40:03,920
few slides about james webb these days

2662
01:40:08,070 --> 01:40:05,760
and this is before the current action in

2663
01:40:09,189 --> 01:40:08,080

the house i get more questions from

2664
01:40:10,550 --> 01:40:09,199
people of your generation about the

2665
01:40:11,910 --> 01:40:10,560
james webb space telescope with any

2666
01:40:14,229 --> 01:40:11,920
other when you see this transformer

2667
01:40:15,750 --> 01:40:14,239
telescope and it's the natural question

2668
01:40:17,669 --> 01:40:15,760
is what you know what's after the hubble

2669
01:40:19,510 --> 01:40:17,679
what's coming next everybody knows after

2670
01:40:21,109 --> 01:40:19,520
the last shuttle program there is no way

2671
01:40:22,390 --> 01:40:21,119
back to repair the hubble space

2672
01:40:24,229 --> 01:40:22,400
telescope

2673
01:40:27,030 --> 01:40:24,239
i mean what people don't probably have

2674
01:40:29,750 --> 01:40:27,040
missed is that five billion impressions

2675
01:40:32,790 --> 01:40:29,760
that's you know people logged on or read

2676
01:40:34,629 --> 01:40:32,800
an article five billion people did this

2677
01:40:35,990 --> 01:40:34,639
during the servicing mission watch the

2678
01:40:38,149 --> 01:40:36,000
astronauts fix the hubble space

2679
01:40:40,470 --> 01:40:38,159
telescope and so people ask

2680
01:40:42,070 --> 01:40:40,480
and so i think the the story you have to

2681
01:40:44,070 --> 01:40:42,080
tell is the true story this is a story

2682
01:40:45,350 --> 01:40:44,080
of discovery it's not a story about well

2683
01:40:46,629 --> 01:40:45,360
these technologies will flow into

2684
01:40:48,870 --> 01:40:46,639
industry and all these kind of things

2685
01:40:50,709 --> 01:40:48,880
that will happen naturally

2686
01:40:52,470 --> 01:40:50,719
but what people

2687
01:40:53,910 --> 01:40:52,480
are inspired by

2688
01:40:55,669 --> 01:40:53,920

is the fact that we can probe to the

2689
01:40:58,310 --> 01:40:55,679
edge of the universe or look for liquid

2690
01:41:01,990 --> 01:40:58,320
water on a planet or another star

2691
01:41:03,590 --> 01:41:02,000
this is our time this is our generation

2692
01:41:06,070 --> 01:41:03,600
we will look back in four or five

2693
01:41:08,149 --> 01:41:06,080
hundred years time and said

2694
01:41:10,229 --> 01:41:08,159
this was the generation that answered

2695
01:41:13,990 --> 01:41:10,239
that question we are no longer alone or

2696
01:41:14,000 --> 01:41:16,950
thank you

2697
01:41:21,830 --> 01:41:18,629
hi i'm chuck

2698
01:41:25,350 --> 01:41:21,840
chuck devine uh i'm probably one of the

2699
01:41:27,430 --> 01:41:25,360
very few polymaths in the audience

2700
01:41:30,149 --> 01:41:27,440
anyhow michelle uh

2701
01:41:32,229 --> 01:41:30,159
i liked your introduction with

2702
01:41:34,870 --> 01:41:32,239
the idea of having this is being driven

2703
01:41:36,790 --> 01:41:34,880
by questions from the audience very much

2704
01:41:38,870 --> 01:41:36,800
i also have to note that this is a one

2705
01:41:42,310 --> 01:41:38,880
hour long session you made that

2706
01:41:44,070 --> 01:41:42,320
statement around 11 20 by my watch uh

2707
01:41:48,229 --> 01:41:44,080
the panel of statements which were

2708
01:41:51,669 --> 01:41:48,239
sometimes very interesting ran until uh

2709
01:41:54,070 --> 01:41:51,679
11 52 by my watch is there any plan to

2710
01:41:55,750 --> 01:41:54,080
actually have any sort of follow up on

2711
01:41:58,830 --> 01:41:55,760
this so that we can

2712
01:42:01,830 --> 01:41:58,840
have a more lengthy and more in-depth uh

2713
01:42:02,870 --> 01:42:01,840

discussion uh obviously after this is

2714
01:42:04,709 --> 01:42:02,880
over

2715
01:42:06,709 --> 01:42:04,719
well we we know that we're up against

2716
01:42:08,470 --> 01:42:06,719
lunch and i i understand that's a

2717
01:42:10,229 --> 01:42:08,480
powerful thing 11 20 is what when

2718
01:42:12,870 --> 01:42:10,239
they've asked us to end the uh the

2719
01:42:15,430 --> 01:42:12,880
session but i i know that i i don't need

2720
01:42:16,870 --> 01:42:15,440
to leave immediately and uh i i think

2721
01:42:18,310 --> 01:42:16,880
that i don't know about my fellow

2722
01:42:20,229 --> 01:42:18,320
panelists but they may be around

2723
01:42:22,310 --> 01:42:20,239
afterwards for more lengthy discussions

2724
01:42:25,510 --> 01:42:22,320
well i'll certainly be around and from

2725
01:42:27,830 --> 01:42:25,520
my standpoint uh our website um

2726
01:42:29,510 --> 01:42:27,840
www.nasa.gov

2727
01:42:31,669 --> 01:42:29,520
chief scientist

2728
01:42:34,070 --> 01:42:31,679
is how you can access us

2729
01:42:36,149 --> 01:42:34,080
and i invite one-on-one dialogue

2730
01:42:39,430 --> 01:42:36,159
multiple dialogue any kind of follow-up

2731
01:42:41,270 --> 01:42:39,440
because we need ideas

2732
01:42:42,470 --> 01:42:41,280
we need to know

2733
01:42:43,669 --> 01:42:42,480
your thoughts

2734
01:42:49,510 --> 01:42:43,679
what

2735
01:42:53,669 --> 01:42:49,520
stimulates the imagination we all know

2736
01:42:58,390 --> 01:42:56,070
carrying that outward gaining or

2737
01:42:59,430 --> 01:42:58,400
generating the appropriate appreciation

2738
01:43:01,510 --> 01:42:59,440

for that

2739
01:43:04,070 --> 01:43:01,520
is is a dialogue i'm happy to have with

2740
01:43:06,709 --> 01:43:04,080
anyone at any time in any forum

2741
01:43:07,990 --> 01:43:06,719
and i'll stay as long as anyone wants

2742
01:43:10,070 --> 01:43:08,000
i've got to flight to chicago to catch

2743
01:43:13,510 --> 01:43:10,080
but we'll stay until then so i have a

2744
01:43:18,070 --> 01:43:14,790
i believe we have another question from

2745
01:43:23,350 --> 01:43:21,189
my name is dk sachdev i'm

2746
01:43:25,510 --> 01:43:23,360
from space still consultancy a small

2747
01:43:28,790 --> 01:43:25,520
company i started 10 years ago and i

2748
01:43:32,709 --> 01:43:28,800
also teach at george mason university

2749
01:43:35,510 --> 01:43:32,719
ever since gemini spacecraft or before

2750
01:43:37,189 --> 01:43:35,520
nasa has been monitoring the health of

2751
01:43:39,270 --> 01:43:37,199
astronauts

2752
01:43:42,070 --> 01:43:39,280
whether in a space capsule or a space

2753
01:43:43,830 --> 01:43:42,080
station or on the moon

2754
01:43:46,470 --> 01:43:43,840
there are all kinds of technologies

2755
01:43:49,910 --> 01:43:46,480
underlying that i'm sure

2756
01:43:51,350 --> 01:43:49,920
today we have a health health care cost

2757
01:43:54,390 --> 01:43:51,360
crisis

2758
01:43:57,910 --> 01:43:54,400
and many senior citizens like me

2759
01:43:59,669 --> 01:43:57,920
who have more and more need for health

2760
01:44:03,430 --> 01:43:59,679
checkups frequently either for

2761
01:44:05,430 --> 01:44:03,440
themselves or their spouses

2762
01:44:07,910 --> 01:44:05,440
still have to go

2763
01:44:10,709 --> 01:44:07,920

to the doctor wait for an hour

2764
01:44:12,550 --> 01:44:10,719
to get some blood pressure checked

2765
01:44:14,870 --> 01:44:12,560
and things like that and come back and

2766
01:44:17,350 --> 01:44:14,880
drive another hour

2767
01:44:19,990 --> 01:44:17,360
why is it that the remote health

2768
01:44:23,109 --> 01:44:20,000
monitoring technology with nasa

2769
01:44:26,070 --> 01:44:23,119
pioneered more than 50 years ago

2770
01:44:29,189 --> 01:44:26,080
is still not a viable commercial

2771
01:44:31,350 --> 01:44:29,199
facility where simple tests can be done

2772
01:44:33,750 --> 01:44:31,360
by remote equipment

2773
01:44:36,229 --> 01:44:33,760
transmitted to the doctor so that they

2774
01:44:38,629 --> 01:44:36,239
don't have to travel and perhaps reduce

2775
01:44:40,790 --> 01:44:38,639
the overall cost

2776
01:44:43,669 --> 01:44:40,800
well i think

2777
01:44:46,070 --> 01:44:43,679
there's sort of two steps in that one in

2778
01:44:49,590 --> 01:44:46,080
your doctor's office you are seeing the

2779
01:44:51,109 --> 01:44:49,600
products of nasa investment

2780
01:44:54,550 --> 01:44:51,119
you are seeing

2781
01:44:57,270 --> 01:44:54,560
you know ekg capabilities and cat scans

2782
01:44:59,669 --> 01:44:57,280
and and you know some very sophisticated

2783
01:45:02,870 --> 01:44:59,679
physics that help us understand the

2784
01:45:05,990 --> 01:45:02,880
human body um and and

2785
01:45:07,510 --> 01:45:06,000
associated elements or challenges

2786
01:45:09,750 --> 01:45:07,520
what you're referring to if i understand

2787
01:45:10,709 --> 01:45:09,760
correctly is remote monitoring where

2788
01:45:13,270 --> 01:45:10,719

where

2789
01:45:14,149 --> 01:45:13,280
you could strap something onto yourself

2790
01:45:15,750 --> 01:45:14,159
and

2791
01:45:17,430 --> 01:45:15,760
transmit

2792
01:45:19,669 --> 01:45:17,440
your blood sugar levels or your

2793
01:45:20,709 --> 01:45:19,679
cholesterol or your heart rate or any of

2794
01:45:32,790 --> 01:45:20,719
that

2795
01:45:35,350 --> 01:45:32,800
viewed as as profitable industry would

2796
01:45:38,870 --> 01:45:35,360
be all over it and it's a

2797
01:45:41,030 --> 01:45:38,880
the capability is there

2798
01:45:43,430 --> 01:45:41,040
turning that into a successful business

2799
01:45:45,270 --> 01:45:43,440
model is is something i don't or i don't

2800
01:45:48,629 --> 01:45:45,280
know that anyone on the panel has enough

2801
01:45:50,390 --> 01:45:48,639
expertise to comment on all i will say

2802
01:45:51,990 --> 01:45:50,400
is that

2803
01:45:54,229 --> 01:45:52,000
when nasa

2804
01:45:56,149 --> 01:45:54,239
investments in technology have produced

2805
01:45:58,950 --> 01:45:56,159
capabilities for which there was a

2806
01:46:00,870 --> 01:45:58,960
recognized market they have flowed into

2807
01:46:01,750 --> 01:46:00,880
the market so if it's not in the market

2808
01:46:03,669 --> 01:46:01,760
yet

2809
01:46:05,510 --> 01:46:03,679
it's either

2810
01:46:07,750 --> 01:46:05,520
that it's it's

2811
01:46:09,030 --> 01:46:07,760
not viewed as being commercially

2812
01:46:11,189 --> 01:46:09,040
profitable

2813
01:46:12,790 --> 01:46:11,199

or no one has thought of it yet so

2814
01:46:14,070 --> 01:46:12,800
perhaps

2815
01:46:16,229 --> 01:46:14,080
you can

2816
01:46:21,109 --> 01:46:16,239
pursue some entrepreneurial endeavors

2817
01:46:25,669 --> 01:46:23,270
thank you

2818
01:46:27,350 --> 01:46:25,679
i'd also point out that after the lunch

2819
01:46:28,870 --> 01:46:27,360
break we're going to be having a panel

2820
01:46:31,350 --> 01:46:28,880
that is going to be talking about

2821
01:46:33,189 --> 01:46:31,360
technology investments and benefits and

2822
01:46:35,350 --> 01:46:33,199
transferring technology

2823
01:46:37,270 --> 01:46:35,360
that's at 130 and they may have some

2824
01:46:39,669 --> 01:46:37,280
experts on that panel that could also

2825
01:46:40,790 --> 01:46:39,679
address that question

2826
01:46:41,750 --> 01:46:40,800
another question from here in the

2827
01:46:42,950 --> 01:46:41,760
audience

2828
01:46:45,270 --> 01:46:42,960
uh yes

2829
01:46:47,030 --> 01:46:45,280
my name is joe fuller i'm the ceo of

2830
01:46:48,390 --> 01:46:47,040
futron corporation

2831
01:46:50,950 --> 01:46:48,400
and i guess i have a question for the

2832
01:46:53,189 --> 01:46:50,960
chief scientist i noticed the title of

2833
01:46:55,030 --> 01:46:53,199
the panelists science and discovery but

2834
01:46:56,870 --> 01:46:55,040
there's no one on here from human space

2835
01:46:59,030 --> 01:46:56,880
flight or exploration you know human

2836
01:47:01,430 --> 01:46:59,040
spaceflight exploration and it seemed to

2837
01:47:02,870 --> 01:47:01,440
be you know they're like three nasas

2838
01:47:04,149 --> 01:47:02,880

you know you've got space sciences

2839
01:47:05,669 --> 01:47:04,159
you've got human space flight and you've

2840
01:47:06,470 --> 01:47:05,679
got aeronautics

2841
01:47:08,629 --> 01:47:06,480
uh

2842
01:47:10,229 --> 01:47:08,639
as chief scientists how do you bring

2843
01:47:11,510 --> 01:47:10,239
these together

2844
01:47:12,709 --> 01:47:11,520
because i don't believe they're that

2845
01:47:14,470 --> 01:47:12,719
separated

2846
01:47:16,709 --> 01:47:14,480
absolutely and that that is a great

2847
01:47:18,950 --> 01:47:16,719
question and thank you for it um

2848
01:47:21,590 --> 01:47:18,960
we don't have the full representation of

2849
01:47:22,950 --> 01:47:21,600
of science disciplines here uh frankly

2850
01:47:25,430 --> 01:47:22,960
we don't we don't have a planetary

2851
01:47:27,990 --> 01:47:25,440
scientist on the panel as well but

2852
01:47:30,229 --> 01:47:28,000
one of the reasons i was brought on

2853
01:47:32,550 --> 01:47:30,239
that the administrator reestablished the

2854
01:47:35,669 --> 01:47:32,560
office of the chief scientist was a

2855
01:47:37,990 --> 01:47:35,679
recognition that not all of the science

2856
01:47:40,390 --> 01:47:38,000
of the agency falls under the science

2857
01:47:42,629 --> 01:47:40,400
mission directorate that

2858
01:47:43,990 --> 01:47:42,639
the ones that fly missions to places

2859
01:47:47,910 --> 01:47:44,000
including earth

2860
01:47:52,709 --> 01:47:50,709
i work very closely with the associate

2861
01:47:54,149 --> 01:47:52,719
administrators of the the

2862
01:47:55,669 --> 01:47:54,159
exploration

2863
01:47:57,750 --> 01:47:55,679

systems mission directorate the

2864
01:47:58,790 --> 01:47:57,760
spacecraft space operations mission

2865
01:48:02,870 --> 01:47:58,800
directorate

2866
01:48:04,390 --> 01:48:02,880
chief technologist leland in the office

2867
01:48:07,270 --> 01:48:04,400
of education

2868
01:48:12,070 --> 01:48:07,280
to to try and bring all this together

2869
01:48:13,510 --> 01:48:12,080
and we have uh allocated a a budget for

2870
01:48:18,390 --> 01:48:13,520
um

2871
01:48:21,030 --> 01:48:18,400
flight science

2872
01:48:23,910 --> 01:48:21,040
integrated research activities that is

2873
01:48:25,830 --> 01:48:23,920
is coming forth uh it's codified in the

2874
01:48:28,310 --> 01:48:25,840
fiscal 13 budget but we're trying to

2875
01:48:31,910 --> 01:48:28,320
take steps in fiscal 12 to try and

2876
01:48:35,270 --> 01:48:31,920
integrate those i do represent to the

2877
01:48:39,430 --> 01:48:37,750
the human research program the life and

2878
01:48:42,229 --> 01:48:39,440
physical sciences

2879
01:48:44,870 --> 01:48:42,239
we've recently

2880
01:48:46,790 --> 01:48:44,880
put forward a reorganization plan that

2881
01:48:49,030 --> 01:48:46,800
brings those into one

2882
01:48:52,629 --> 01:48:49,040
organization so that there's a critical

2883
01:48:54,709 --> 01:48:52,639
mass and advocacy as part of the science

2884
01:48:56,950 --> 01:48:54,719
and the agency so

2885
01:48:59,750 --> 01:48:56,960
historically the life and physical

2886
01:49:01,430 --> 01:48:59,760
sciences has been about

2887
01:49:03,750 --> 01:49:01,440
supporting human space flight and

2888
01:49:05,590 --> 01:49:03,760

understanding biology and physics in the

2889
01:49:07,109 --> 01:49:05,600
microgravity environment and it's been a

2890
01:49:09,030 --> 01:49:07,119
part of the

2891
01:49:10,790 --> 01:49:09,040
human space flight program because

2892
01:49:12,550 --> 01:49:10,800
that's where the science has been done

2893
01:49:14,229 --> 01:49:12,560
that's where that's where it's been

2894
01:49:16,790 --> 01:49:14,239
managed

2895
01:49:19,030 --> 01:49:16,800
my appointment and the reorganization is

2896
01:49:21,830 --> 01:49:19,040
really an effort to

2897
01:49:24,229 --> 01:49:21,840
have a flow of that kind of science up

2898
01:49:26,950 --> 01:49:24,239
to the administrator level in parallel

2899
01:49:30,470 --> 01:49:26,960
with the kinds of missions we do so it's

2900
01:49:33,189 --> 01:49:30,480
recognized it's being addressed and

2901
01:49:34,790 --> 01:49:33,199
checked back with me in about a year

2902
01:49:37,030 --> 01:49:34,800
and let me know how you think we're

2903
01:49:40,070 --> 01:49:37,040
doing and the last thing i'll add is the

2904
01:49:41,430 --> 01:49:40,080
national or the space station has just

2905
01:49:44,229 --> 01:49:41,440
been

2906
01:49:46,709 --> 01:49:44,239
declared a national laboratory with a

2907
01:49:48,709 --> 01:49:46,719
non-profit organization running it much

2908
01:49:52,229 --> 01:49:48,719
in the same model as the space telescope

2909
01:49:53,750 --> 01:49:52,239
science institute to

2910
01:49:56,310 --> 01:49:53,760
to generate

2911
01:49:58,470 --> 01:49:56,320
or optimize utilization of the space

2912
01:50:00,629 --> 01:49:58,480
station itself so we're making steps to

2913
01:50:02,470 --> 01:50:00,639

bring that science

2914
01:50:04,390 --> 01:50:02,480
forward

2915
01:50:07,430 --> 01:50:04,400
and integrate it with the other aspects

2916
01:50:10,870 --> 01:50:09,030
in the in the interest of full

2917
01:50:12,229 --> 01:50:10,880
participation from the the panel i think

2918
01:50:14,870 --> 01:50:12,239
i'd actually like to see if i can shoot

2919
01:50:16,390 --> 01:50:14,880
something to david pierce here and uh

2920
01:50:18,470 --> 01:50:16,400
we're talking a bit about what's over

2921
01:50:20,470 --> 01:50:18,480
the horizon you know what what's the the

2922
01:50:22,629 --> 01:50:20,480
most amazing discovery you see coming up

2923
01:50:23,669 --> 01:50:22,639
right you know beyond the curve

2924
01:50:25,669 --> 01:50:23,679
you have a chance to see some of the

2925
01:50:26,470 --> 01:50:25,679
technology that's being prototyped right

2926
01:50:28,229 --> 01:50:26,480
now

2927
01:50:30,550 --> 01:50:28,239
and uh and as you said i mean this is

2928
01:50:32,709 --> 01:50:30,560
really the bleeding edge of technology

2929
01:50:33,750 --> 01:50:32,719
you test it at a place like wallops

2930
01:50:35,750 --> 01:50:33,760
could you comment a bit about what

2931
01:50:38,149 --> 01:50:35,760
you're seeing well uh michelle what

2932
01:50:40,470 --> 01:50:38,159
we're doing with um our suborbital

2933
01:50:42,470 --> 01:50:40,480
platforms is we see that the next

2934
01:50:44,709 --> 01:50:42,480
generation of earth science instruments

2935
01:50:46,870 --> 01:50:44,719
are being flown uh we're bridging

2936
01:50:49,350 --> 01:50:46,880
between icesat

2937
01:50:52,229 --> 01:50:49,360
one and what would hopefully be icesat-2

2938
01:50:54,709 --> 01:50:52,239

with icebridge and that's a subject near

2939
01:50:56,149 --> 01:50:54,719
and dear to waleed's heart

2940
01:50:57,430 --> 01:50:56,159
it's an exciting program

2941
01:50:59,510 --> 01:50:57,440
and

2942
01:51:01,750 --> 01:50:59,520
working with researchers to be on the

2943
01:51:03,990 --> 01:51:01,760
cutting edge of advanced instruments

2944
01:51:06,550 --> 01:51:04,000
that are going to support earth science

2945
01:51:09,189 --> 01:51:06,560
as well as in space science developing

2946
01:51:10,709 --> 01:51:09,199
platforms uh and then taking advantage

2947
01:51:13,589 --> 01:51:10,719
of commercial platforms that are going

2948
01:51:16,709 --> 01:51:13,599
to become available um to

2949
01:51:19,430 --> 01:51:16,719
do cutting-edge space science work

2950
01:51:21,750 --> 01:51:19,440
studying a hard x-rays

2951
01:51:24,870 --> 01:51:21,760
looking at planetary science from a

2952
01:51:27,990 --> 01:51:24,880
balloon where you look at and seeing if

2953
01:51:30,149 --> 01:51:28,000
you can find or detect a planet around

2954
01:51:31,510 --> 01:51:30,159
another star

2955
01:51:33,830 --> 01:51:31,520
looking at

2956
01:51:36,070 --> 01:51:33,840
fine fine pointing and those kinds of

2957
01:51:38,149 --> 01:51:36,080
systems that we're developing to enable

2958
01:51:42,070 --> 01:51:38,159
that kind of science

2959
01:51:44,470 --> 01:51:42,080
and in terms of cosmic rays

2960
01:51:47,350 --> 01:51:44,480
making those kinds of measurements from

2961
01:51:50,310 --> 01:51:47,360
ultra long duration flights where these

2962
01:51:53,430 --> 01:51:50,320
platforms will fly for hundreds of days

2963
01:51:56,070 --> 01:51:53,440

thus becoming satellites on a string

2964
01:51:58,149 --> 01:51:56,080
to test out these technologies and do

2965
01:51:59,669 --> 01:51:58,159
cutting-edge science so

2966
01:52:01,990 --> 01:51:59,679
that's some of the kind of stuff that

2967
01:52:03,189 --> 01:52:02,000
we're seeing on our end down at wallops

2968
01:52:04,950 --> 01:52:03,199
i'm not sure everybody's familiar with

2969
01:52:07,109 --> 01:52:04,960
operation icebridge this is a fairly

2970
01:52:08,629 --> 01:52:07,119
exciting thing icesat of course is the

2971
01:52:10,870 --> 01:52:08,639
the satellite that has been doing laser

2972
01:52:13,910 --> 01:52:10,880
altimetry uh studying the extent of sea

2973
01:52:15,830 --> 01:52:13,920
ice at the poles icesat won

2974
01:52:17,990 --> 01:52:15,840
the original icesat stopped operations

2975
01:52:19,750 --> 01:52:18,000
earlier this year and icesat-2 is in

2976
01:52:22,229 --> 01:52:19,760
development so between those two

2977
01:52:25,270 --> 01:52:22,239
satellites we have a data gap at a time

2978
01:52:27,430 --> 01:52:25,280
when sea ice is dropping precipitously

2979
01:52:30,390 --> 01:52:27,440
and so the the icebridge mission is an

2980
01:52:33,830 --> 01:52:30,400
aircraft mission that's correct and uh

2981
01:52:34,629 --> 01:52:33,840
it's between aircraft at nasa dryden and

2982
01:52:43,589 --> 01:52:34,639
uh

2983
01:52:46,629 --> 01:52:43,599
up

2984
01:52:48,629 --> 01:52:46,639
global hawk is a platform that nasa

2985
01:52:50,629 --> 01:52:48,639
dryden's bringing online and can you

2986
01:52:52,629 --> 01:52:50,639
imagine flying

2987
01:52:54,790 --> 01:52:52,639
sensors on a global hawk that could stay

2988
01:52:57,109 --> 01:52:54,800

up for 30 hours at a time and then you

2989
01:52:59,910 --> 01:52:57,119
could refuel it so it could stay on

2990
01:53:01,830 --> 01:52:59,920
a station for a lot longer and flying

2991
01:53:04,470 --> 01:53:01,840
out of west africa say flying out of the

2992
01:53:07,109 --> 01:53:04,480
canary islands and monitoring these

2993
01:53:09,910 --> 01:53:07,119
waves coming off of africa to try to

2994
01:53:12,550 --> 01:53:09,920
discover and understand how

2995
01:53:15,109 --> 01:53:12,560
those waves turn into hurricanes

2996
01:53:17,270 --> 01:53:15,119
to help protect our coastline it's very

2997
01:53:19,350 --> 01:53:17,280
exciting what's being done to

2998
01:53:21,990 --> 01:53:19,360
develop these platforms extend their

2999
01:53:23,510 --> 01:53:22,000
capabilities to support both earth and

3000
01:53:25,189 --> 01:53:23,520
space science

3001
01:53:28,149 --> 01:53:25,199
yeah i'll just mention you know global

3002
01:53:29,910 --> 01:53:28,159
hawk is a great example of the nasa noaa

3003
01:53:31,669 --> 01:53:29,920
relationship we're working together with

3004
01:53:33,430 --> 01:53:31,679
that instrumentation

3005
01:53:35,669 --> 01:53:33,440
where we can put these observations

3006
01:53:38,070 --> 01:53:35,679
where we really need them using these

3007
01:53:40,629 --> 01:53:38,080
unmanned aircraft platforms and new

3008
01:53:42,790 --> 01:53:40,639
observations that we can assimilate into

3009
01:53:44,950 --> 01:53:42,800
our numerical weather prediction models

3010
01:53:47,270 --> 01:53:44,960
and really make an impact on society so

3011
01:53:49,270 --> 01:53:47,280
it's a good example and in these budget

3012
01:53:52,070 --> 01:53:49,280
constrained times i would submit wally

3013
01:53:54,470 --> 01:53:52,080

that these these provide a capability to

3014
01:53:56,870 --> 01:53:54,480
do cutting edge science while we're

3015
01:53:58,790 --> 01:53:56,880
waiting to build the next

3016
01:54:00,950 --> 01:53:58,800
large spacecrafts in some respects well

3017
01:54:03,350 --> 01:54:00,960
and as someone who spent months sleeping

3018
01:54:05,270 --> 01:54:03,360
in 40 below zero temperatures in a tent

3019
01:54:08,470 --> 01:54:05,280
in greenland i see a lot of value to

3020
01:54:09,430 --> 01:54:08,480
these things

3021
01:54:12,950 --> 01:54:09,440
i believe we have a question from the

3022
01:54:15,270 --> 01:54:12,960
audience yes my question has to do with

3023
01:54:18,070 --> 01:54:15,280
why in recent years the

3024
01:54:21,750 --> 01:54:18,080
availability of nasa television

3025
01:54:23,830 --> 01:54:21,760
has become less and less available is

3026
01:54:25,750 --> 01:54:23,840
cables tv stations including the

3027
01:54:28,470 --> 01:54:25,760
university of maryland tv have

3028
01:54:31,189 --> 01:54:28,480
discontinued it

3029
01:54:34,790 --> 01:54:31,199
is there a reason

3030
01:54:38,229 --> 01:54:36,550
i guess i think i think maybe take a

3031
01:54:40,550 --> 01:54:38,239
stab at that

3032
01:54:42,709 --> 01:54:40,560
we make nasa television available to

3033
01:54:45,350 --> 01:54:42,719
anyone who would like to air it

3034
01:54:47,990 --> 01:54:45,360
um we make it available to the public

3035
01:54:50,070 --> 01:54:48,000
into cable channels all over the world

3036
01:54:51,910 --> 01:54:50,080
all over the country and and we also now

3037
01:54:54,870 --> 01:54:51,920
stream it over the internet at

3038
01:54:56,390 --> 01:54:54,880

www.nasa.gov

3039
01:54:57,709 --> 01:54:56,400
ntv

3040
01:55:00,390 --> 01:54:57,719
that's

3041
01:55:02,790 --> 01:55:00,400
www.nasa.gov slash ntv

3042
01:55:04,950 --> 01:55:02,800
we do we have actually amplified the

3043
01:55:07,430 --> 01:55:04,960
audience tremendously thanks to the

3044
01:55:09,109 --> 01:55:07,440
internet and we have lots of viewers who

3045
01:55:10,629 --> 01:55:09,119
are joining us here today

3046
01:55:12,390 --> 01:55:10,639
uh via the web

3047
01:55:13,910 --> 01:55:12,400
but as for the cable companies that's

3048
01:55:16,550 --> 01:55:13,920
their prerogative as to whether they

3049
01:55:17,910 --> 01:55:16,560
choose to put us on or not

3050
01:55:19,350 --> 01:55:17,920
actually one of the things i'll comment

3051
01:55:21,990 --> 01:55:19,360
on is just sort of i believe a change in

3052
01:55:24,229 --> 01:55:22,000
the media environment as well um i i've

3053
01:55:26,709 --> 01:55:24,239
seen people now very look for very

3054
01:55:29,669 --> 01:55:26,719
specific content uh instead of looking

3055
01:55:31,350 --> 01:55:29,679
at a beautifully architectured website

3056
01:55:33,270 --> 01:55:31,360
which i have you know i've spent years

3057
01:55:34,870 --> 01:55:33,280
of my life trying to create they will do

3058
01:55:36,629 --> 01:55:34,880
a google search on a topic they want and

3059
01:55:39,109 --> 01:55:36,639
they will just go right into you know a

3060
01:55:41,589 --> 01:55:39,119
third or fourth level page there there's

3061
01:55:44,310 --> 01:55:41,599
a very much of a directed look at you

3062
01:55:46,310 --> 01:55:44,320
know getting exactly what you need

3063
01:55:48,870 --> 01:55:46,320

nasa television and actually tv in

3064
01:55:50,629 --> 01:55:48,880
general may be dying away from that idea

3065
01:55:52,550 --> 01:55:50,639
that it's continuously on it's something

3066
01:55:54,310 --> 01:55:52,560
you can plug in at any time there's some

3067
01:55:56,390 --> 01:55:54,320
sort of scheduled content and said

3068
01:55:58,870 --> 01:55:56,400
people want things they can use in in

3069
01:56:00,629 --> 01:55:58,880
exactly the time and place they want now

3070
01:56:02,709 --> 01:56:00,639
the the video that's being produced by

3071
01:56:05,189 --> 01:56:02,719
nasa in terms of podcasts video

3072
01:56:07,910 --> 01:56:05,199
broadcasts your short little

3073
01:56:09,270 --> 01:56:07,920
things on the web it it's tremendous i

3074
01:56:11,669 --> 01:56:09,280
mean we really have some of the best

3075
01:56:13,109 --> 01:56:11,679
video producers the best animators

3076
01:56:15,589 --> 01:56:13,119
i'm one of the hosts for the discovery

3077
01:56:17,510 --> 01:56:15,599
channels how the universe works and

3078
01:56:19,589 --> 01:56:17,520
probably a good 50 percent of that show

3079
01:56:21,750 --> 01:56:19,599
which is for profit that we don't get is

3080
01:56:23,270 --> 01:56:21,760
our nasa animation with with me that

3081
01:56:24,709 --> 01:56:23,280
again i don't get any money for they

3082
01:56:27,109 --> 01:56:24,719
come they film us they create a

3083
01:56:29,189 --> 01:56:27,119
for-profit show based on nasa content

3084
01:56:31,430 --> 01:56:29,199
and people very deliberately search for

3085
01:56:32,310 --> 01:56:31,440
a twitter feed for news about a specific

3086
01:56:33,830 --> 01:56:32,320
mission

3087
01:56:35,910 --> 01:56:33,840
so to some degree it's a change in the

3088
01:56:37,830 --> 01:56:35,920

media environment and i i think that

3089
01:56:39,750 --> 01:56:37,840
television in general broadcasting in

3090
01:56:41,189 --> 01:56:39,760
general is trying to figure out how to

3091
01:56:43,109 --> 01:56:41,199
respond to that

3092
01:56:44,790 --> 01:56:43,119
and in some respects nasa has been ahead

3093
01:56:45,990 --> 01:56:44,800
of the curve we've been doing these very

3094
01:56:47,109 --> 01:56:46,000
directed

3095
01:56:48,390 --> 01:56:47,119
you know every mission should have a

3096
01:56:50,870 --> 01:56:48,400
twitter feed every mission needs a

3097
01:56:52,390 --> 01:56:50,880
facebook page every mission needs a very

3098
01:56:54,470 --> 01:56:52,400
good video production team to do the

3099
01:56:59,510 --> 01:56:54,480
podcasting so it's somewhat of a change

3100
01:57:04,229 --> 01:57:01,830
we've been talking today a bit about uh

3101
01:57:05,750 --> 01:57:04,239
the image of nasa uh somebody commented

3102
01:57:07,830 --> 01:57:05,760
that there wasn't a human space flight

3103
01:57:09,030 --> 01:57:07,840
person on this panel

3104
01:57:11,189 --> 01:57:09,040
one of the things that i found

3105
01:57:13,030 --> 01:57:11,199
challenging is is is telling people

3106
01:57:15,510 --> 01:57:13,040
about the incredible science that nasa

3107
01:57:17,669 --> 01:57:15,520
does when it's true that we have so much

3108
01:57:19,669 --> 01:57:17,679
to owe the human space flight program in

3109
01:57:21,510 --> 01:57:19,679
terms of inspiration and for the the

3110
01:57:23,030 --> 01:57:21,520
nasa brand for what people think of when

3111
01:57:25,830 --> 01:57:23,040
they think of nasa

3112
01:57:28,310 --> 01:57:25,840
one question i have for the panelists um

3113
01:57:30,870 --> 01:57:28,320

another change that's happening soon i

3114
01:57:33,270 --> 01:57:30,880
think is the the real branding of nasa

3115
01:57:35,990 --> 01:57:33,280
as an earth science

3116
01:57:37,189 --> 01:57:36,000
brand advocate you know for predictions

3117
01:57:38,629 --> 01:57:37,199
as to what's going to happen what's

3118
01:57:40,390 --> 01:57:38,639
happening to the climate that the

3119
01:57:41,830 --> 01:57:40,400
measurements we saw a press release out

3120
01:57:43,430 --> 01:57:41,840
of grace the gravity recovery and

3121
01:57:44,950 --> 01:57:43,440
climate experiment about the earth

3122
01:57:46,550 --> 01:57:44,960
literally getting fatter that water is

3123
01:57:49,030 --> 01:57:46,560
beginning to pool at the equator because

3124
01:57:50,629 --> 01:57:49,040
of the melt from greenland

3125
01:57:55,109 --> 01:57:50,639
say something about

3126
01:57:56,950 --> 01:57:55,119
how nasa is going to work to actually

3127
01:57:58,870 --> 01:57:56,960
we're the nation's space program but but

3128
01:58:00,550 --> 01:57:58,880
we're also going to become the nation's

3129
01:58:03,669 --> 01:58:00,560
earth science program

3130
01:58:05,270 --> 01:58:03,679
well i i i'll jump in at that uh

3131
01:58:08,950 --> 01:58:05,280
one cannot do

3132
01:58:11,830 --> 01:58:08,960
birth science without the space view

3133
01:58:14,950 --> 01:58:11,840
i often in talks refer to the earth and

3134
01:58:17,910 --> 01:58:14,960
tony alluded to this as a mosaic of

3135
01:58:19,669 --> 01:58:17,920
stories it's a bunch of tiles each one

3136
01:58:21,589 --> 01:58:19,679
is an element of what we call the earth

3137
01:58:23,350 --> 01:58:21,599
system and until you put the tiles

3138
01:58:25,830 --> 01:58:23,360

together and view them from the right

3139
01:58:27,990 --> 01:58:25,840
perspective from the right context

3140
01:58:30,870 --> 01:58:28,000
you don't really understand the picture

3141
01:58:33,030 --> 01:58:30,880
that's being told so while we need

3142
01:58:35,589 --> 01:58:33,040
boots on the ground boots in the ice

3143
01:58:37,830 --> 01:58:35,599
fins in the water all of these things

3144
01:58:38,790 --> 01:58:37,840
to understand the detailed processes on

3145
01:58:40,390 --> 01:58:38,800
earth

3146
01:58:44,070 --> 01:58:40,400
without integrating them into a

3147
01:58:46,070 --> 01:58:44,080
systematic kind of view or approach

3148
01:58:48,390 --> 01:58:46,080
we will never get

3149
01:58:50,229 --> 01:58:48,400
the full story or as full of stories we

3150
01:58:53,030 --> 01:58:50,239
need to be successful in the face of a

3151
01:58:56,229 --> 01:58:53,040
changing environment so nasa really

3152
01:58:58,629 --> 01:58:56,239
remains um

3153
01:59:00,870 --> 01:58:58,639
a fundamental

3154
01:59:02,790 --> 01:59:00,880
not just foundation of understanding the

3155
01:59:04,709 --> 01:59:02,800
error system but but i think the very

3156
01:59:07,750 --> 01:59:04,719
fabric against which all the elements

3157
01:59:08,950 --> 01:59:07,760
are or into which all these elements are

3158
01:59:10,390 --> 01:59:08,960
woven

3159
01:59:12,629 --> 01:59:10,400
i mean let me just even answer as an

3160
01:59:14,310 --> 01:59:12,639
astrophysicist

3161
01:59:16,870 --> 01:59:14,320
it's going to be impossible for us to

3162
01:59:18,629 --> 01:59:16,880
recognize life another planet unless we

3163
01:59:20,390 --> 01:59:18,639

actually understand what life looks like

3164
01:59:21,830 --> 01:59:20,400
on this planet and what the interactions

3165
01:59:22,870 --> 01:59:21,840
are because the planets that we will

3166
01:59:24,550 --> 01:59:22,880
look for

3167
01:59:27,030 --> 01:59:24,560
will be very different from the ones

3168
01:59:28,950 --> 01:59:27,040
we're living on

3169
01:59:31,510 --> 01:59:28,960
and i think that it's the systems

3170
01:59:33,510 --> 01:59:31,520
approach understanding our earth system

3171
01:59:35,990 --> 01:59:33,520
even helps the astrophysicists

3172
01:59:37,669 --> 01:59:36,000
understand other earth systems i think

3173
01:59:39,189 --> 01:59:37,679
that's a key

3174
01:59:40,950 --> 01:59:39,199
linkage that even our own colleagues

3175
01:59:42,629 --> 01:59:40,960
don't always appreciate on the

3176
01:59:45,430 --> 01:59:42,639
astrophysics side

3177
01:59:47,830 --> 01:59:45,440
it's all part of the same endeavor

3178
01:59:48,950 --> 01:59:47,840
understanding a system of life whether

3179
01:59:51,830 --> 01:59:48,960
it be here

3180
01:59:53,669 --> 01:59:51,840
or 25 light years from here

3181
01:59:55,270 --> 01:59:53,679
yeah i'll just mention from the weather

3182
01:59:57,270 --> 01:59:55,280
side i mean it's somewhat of a

3183
01:59:58,709 --> 01:59:57,280
revolution of moving towards this

3184
02:00:00,950 --> 01:59:58,719
thinking about the weather problem as an

3185
02:00:03,270 --> 02:00:00,960
earth systems problem coupling the

3186
02:00:06,470 --> 02:00:03,280
oceans to the atmosphere coupling the

3187
02:00:09,030 --> 02:00:06,480
the cryosphere uh you know in in and the

3188
02:00:11,990 --> 02:00:09,040

biosphere as well it all really does

3189
02:00:14,229 --> 02:00:12,000
matter and uh so nasa has been certainly

3190
02:00:16,870 --> 02:00:14,239
a collaborator in that effort with noaa

3191
02:00:19,910 --> 02:00:16,880
so let me peek into the crystal ball a

3192
02:00:21,430 --> 02:00:19,920
little bit um looking to the future

3193
02:00:24,870 --> 02:00:21,440
significant change has happened to nasa

3194
02:00:27,910 --> 02:00:24,880
over the past couple years where

3195
02:00:30,310 --> 02:00:27,920
nasa has now taken on the responsibility

3196
02:00:33,589 --> 02:00:30,320
that the science it does

3197
02:00:36,310 --> 02:00:33,599
um from observing the earth just can't

3198
02:00:38,709 --> 02:00:36,320
stop with a data stream after two or

3199
02:00:41,189 --> 02:00:38,719
three years that the science we're

3200
02:00:44,310 --> 02:00:41,199
studying the time skills we're studying

3201
02:00:47,830 --> 02:00:44,320
require observations that again goes

3202
02:00:49,750 --> 02:00:47,840
from days to decades and so

3203
02:00:51,990 --> 02:00:49,760
totally apart from operations totalling

3204
02:00:54,070 --> 02:00:52,000
apart from monitoring the science of the

3205
02:00:55,589 --> 02:00:54,080
planet is on these longer time scales

3206
02:00:58,149 --> 02:00:55,599
and that impacts

3207
02:01:00,149 --> 02:00:58,159
the science that nasa is doing

3208
02:01:03,270 --> 02:01:00,159
but these observations are just alluded

3209
02:01:05,430 --> 02:01:03,280
to by david if we kind of go back to

3210
02:01:06,870 --> 02:01:05,440
the heritage for earth remote sensing

3211
02:01:09,030 --> 02:01:06,880
goes back to

3212
02:01:11,189 --> 02:01:09,040
as i said at the beginning of

3213
02:01:12,709 --> 02:01:11,199

observations and support of numerical

3214
02:01:15,109 --> 02:01:12,719
weather prediction

3215
02:01:17,750 --> 02:01:15,119
and i would posit that where we are

3216
02:01:20,470 --> 02:01:17,760
right now in earth system science is

3217
02:01:22,550 --> 02:01:20,480
much akin to where we were coming out of

3218
02:01:23,990 --> 02:01:22,560
world war ii with respect to numerical

3219
02:01:26,390 --> 02:01:24,000
weather prediction

3220
02:01:28,790 --> 02:01:26,400
that our understanding of the physics of

3221
02:01:29,669 --> 02:01:28,800
the atmosphere at that time

3222
02:01:32,070 --> 02:01:29,679
uh

3223
02:01:34,629 --> 02:01:32,080
the present state of digital computing

3224
02:01:37,350 --> 02:01:34,639
at that time

3225
02:01:40,070 --> 02:01:37,360
the nascent models of

3226
02:01:44,070 --> 02:01:40,080
weather at that time

3227
02:01:45,350 --> 02:01:44,080
ushered in this era of numerical weather

3228
02:01:47,589 --> 02:01:45,360
prediction

3229
02:01:49,669 --> 02:01:47,599
so that you have the forecast that dave

3230
02:01:52,470 --> 02:01:49,679
alluded to i would argue we're at that

3231
02:01:54,790 --> 02:01:52,480
position now for prediction of the earth

3232
02:01:59,030 --> 02:01:54,800
system and that for

3233
02:02:00,390 --> 02:01:59,040
25 years from now we will have reliable

3234
02:02:02,790 --> 02:02:00,400
actionable

3235
02:02:06,229 --> 02:02:02,800
predictions of the earth systems not

3236
02:02:09,030 --> 02:02:06,239
just weather but how the earth acts as a

3237
02:02:11,589 --> 02:02:09,040
coupled system on these time scales from

3238
02:02:13,270 --> 02:02:11,599

days to decades and and really it's all

3239
02:02:15,830 --> 02:02:13,280
attributable to

3240
02:02:17,189 --> 02:02:15,840
these fundamental observations

3241
02:02:19,430 --> 02:02:17,199
that nasa

3242
02:02:21,750 --> 02:02:19,440
laid forth in the 80s and 90s that go

3243
02:02:24,149 --> 02:02:21,760
way beyond weather it's monitoring the

3244
02:02:26,310 --> 02:02:24,159
earth as a system and now we have the

3245
02:02:29,189 --> 02:02:26,320
prospects for predicting the earth as a

3246
02:02:32,149 --> 02:02:30,310
okay i guess with that we should

3247
02:02:34,950 --> 02:02:32,159
probably wrap it up it's time to wrap up

3248
02:02:37,910 --> 02:02:35,830
uh

3249
02:02:39,430 --> 02:02:37,920
i'd like to thank our panel it's been a

3250
02:02:41,990 --> 02:02:39,440
great discussion

3251
02:02:46,070 --> 02:02:42,000
we're going to take a break now and

3252
02:02:48,709 --> 02:02:46,080
regroup here at 1 30 p.m eastern time