
SAasteroid
Aasteroid
David
Delgado

1
00:00:09,990 --> 00:00:07,829
welcome we are coming to you live on

2
00:00:12,470 --> 00:00:10,000
nasa tv from

3
00:00:15,829 --> 00:00:12,480
the asteroid initiative ideas synthesis

4
00:00:17,670 --> 00:00:15,839
workshop it's our final day we've had

5
00:00:18,950 --> 00:00:17,680
two great days although they were split

6
00:00:22,070 --> 00:00:18,960
up

7
00:00:23,029 --> 00:00:22,080
a great conversation and we start this

8
00:00:24,790 --> 00:00:23,039
morning

9
00:00:25,750 --> 00:00:24,800
with the next generation engagement

10
00:00:28,950 --> 00:00:25,760
panel

11
00:00:31,429 --> 00:00:28,960
it's an asteroid grand challenge focused

12
00:00:33,750 --> 00:00:31,439
panel and

13
00:00:35,990 --> 00:00:33,760

my name is jason kessler i am the

14
00:00:37,030 --> 00:00:36,000
asteroid grand challenge program

15
00:00:39,110 --> 00:00:37,040
executive

16
00:00:42,549 --> 00:00:39,120
based in washington dc

17
00:00:44,470 --> 00:00:42,559
and with me as co-lead is jen gastetic

18
00:00:45,510 --> 00:00:44,480
the program exec for prizes and

19
00:00:47,110 --> 00:00:45,520
challenges

20
00:00:49,750 --> 00:00:47,120
also at

21
00:00:52,150 --> 00:00:49,760
nasa headquarters in dc

22
00:00:53,110 --> 00:00:52,160
our moderator this morning is joe gard

23
00:00:54,950 --> 00:00:53,120
who

24
00:00:57,590 --> 00:00:54,960
works down here in houston at the

25
00:00:59,750 --> 00:00:57,600
johnson space center

26
00:01:02,069 --> 00:00:59,760
so to get things started

27
00:01:07,429 --> 00:01:02,079
we have

28
00:01:11,750 --> 00:01:10,469
alex hall was not able to participate

29
00:01:13,429 --> 00:01:11,760
and so

30
00:01:14,950 --> 00:01:13,439
we're going to start with kevin barry

31
00:01:16,310 --> 00:01:14,960
who's representing the lifeboat

32
00:01:18,710 --> 00:01:16,320
foundation

33
00:01:20,469 --> 00:01:18,720
we'll move to david delgado from the jet

34
00:01:22,070 --> 00:01:20,479
propulsion laboratory

35
00:01:24,469 --> 00:01:22,080
and then eric de jong

36
00:01:27,990 --> 00:01:24,479
also from the jet propulsion laboratory

37
00:01:31,670 --> 00:01:28,000
we'll be presenting the plan is to have

38
00:01:33,590 --> 00:01:31,680

questions after each speaker

39
00:01:35,590 --> 00:01:33,600
kevin's going to have to depart before

40
00:01:38,149 --> 00:01:35,600
we wrap up and so we want to make sure

41
00:01:41,030 --> 00:01:38,159
to be able to get questions to him

42
00:01:42,950 --> 00:01:41,040
before we break and then jump into some

43
00:01:43,990 --> 00:01:42,960
discussion to figure out how can we move

44
00:01:46,550 --> 00:01:44,000
forward

45
00:01:49,030 --> 00:01:46,560
uh the grand challenge is a new approach

46
00:01:50,870 --> 00:01:49,040
for nasa and we want to figure out are

47
00:01:54,230 --> 00:01:50,880
there new methods

48
00:01:56,950 --> 00:01:54,240
of engagement and how do we connect with

49
00:02:02,149 --> 00:01:59,030
so as a refresher you might be getting

50
00:02:03,910 --> 00:02:02,159
sick of of this slide we'll maybe this

51
00:02:06,389 --> 00:02:03,920
panel will help us figure out how to do

52
00:02:08,070 --> 00:02:06,399
a better job

53
00:02:10,229 --> 00:02:08,080
the grand challenge statement to find

54
00:02:11,910 --> 00:02:10,239
all asteroid threats to human

55
00:02:12,949 --> 00:02:11,920
populations and know what to do about

56
00:02:15,110 --> 00:02:12,959
them

57
00:02:17,190 --> 00:02:15,120
i think everyone agrees that is a grand

58
00:02:20,150 --> 00:02:17,200
challenge

59
00:02:21,190 --> 00:02:20,160
and the images are very clear reminders

60
00:02:23,190 --> 00:02:21,200
of

61
00:02:25,190 --> 00:02:23,200
why we need to be thinking about this

62
00:02:27,270 --> 00:02:25,200
the image on the right

63
00:02:29,270 --> 00:02:27,280

from this very year

64
00:02:31,750 --> 00:02:29,280
an in

65
00:02:32,790 --> 00:02:31,760
a meteor that

66
00:02:37,589 --> 00:02:32,800
exploded

67
00:02:40,470 --> 00:02:37,599
just north of chelyabinsk in russia

68
00:02:43,750 --> 00:02:40,480
injuring over a thousand and costing

69
00:02:48,830 --> 00:02:43,760
upwards of 40 million dollars in damage

70
00:02:56,070 --> 00:02:51,670
neighborhood another slide

71
00:02:59,190 --> 00:02:56,080
to put in context the grand challenge

72
00:03:00,309 --> 00:02:59,200
and the mission both of which

73
00:03:03,030 --> 00:03:00,319
we're here

74
00:03:04,869 --> 00:03:03,040
in houston talking about

75
00:03:06,390 --> 00:03:04,879
great overlap between the two and so i

76
00:03:08,229 --> 00:03:06,400
think

77
00:03:10,949 --> 00:03:08,239
while we have a focus on the grand

78
00:03:12,229 --> 00:03:10,959
challenge in this session um

79
00:03:14,710 --> 00:03:12,239
this morning

80
00:03:16,790 --> 00:03:14,720
there's no reason why we need to limit

81
00:03:20,149 --> 00:03:16,800
the thinking about this next generation

82
00:03:23,030 --> 00:03:20,159
engagement simply to the grand challenge

83
00:03:25,270 --> 00:03:23,040
and so as we go through our discussion

84
00:03:28,630 --> 00:03:25,280
let's keep our minds wide and think

85
00:03:30,070 --> 00:03:28,640
about how can we include this thinking

86
00:03:32,309 --> 00:03:30,080
as we begin

87
00:03:34,470 --> 00:03:32,319
to really push out into the public the

88
00:03:41,030 --> 00:03:34,480

the ideas behind the redirect mission as

89
00:03:47,110 --> 00:03:43,190
so some desired outcomes for this

90
00:03:50,309 --> 00:03:48,390
i think it's important that we get a

91
00:03:53,509 --> 00:03:50,319
shared understanding of of what we're

92
00:03:55,589 --> 00:03:53,519
even meaning by uh

93
00:03:58,470 --> 00:03:55,599
next generation engagement

94
00:04:00,070 --> 00:03:58,480
uh maybe we won't get to a shared

95
00:04:02,789 --> 00:04:00,080
understanding this morning but at least

96
00:04:04,470 --> 00:04:02,799
begin the conversation of uh

97
00:04:06,789 --> 00:04:04,480
what we're doing well

98
00:04:09,589 --> 00:04:06,799
what needs improvement are there new

99
00:04:11,350 --> 00:04:09,599
ideas on how we do that engagement

100
00:04:13,910 --> 00:04:11,360
there's a

101
00:04:16,550 --> 00:04:13,920
ability to connect to a population like

102
00:04:20,310 --> 00:04:16,560
like we haven't seen before we have more

103
00:04:25,110 --> 00:04:22,230
and access than

104
00:04:26,469 --> 00:04:25,120
than ever before and

105
00:04:28,390 --> 00:04:26,479
there are ways that we can start

106
00:04:31,350 --> 00:04:28,400
thinking about the work that we do and

107
00:04:33,590 --> 00:04:31,360
connecting it to the people that

108
00:04:35,430 --> 00:04:33,600
are kind enough to pay taxes so that we

109
00:04:37,030 --> 00:04:35,440
can even do this work and so i think

110
00:04:38,950 --> 00:04:37,040
it's important that we

111
00:04:41,270 --> 00:04:38,960
really start to think broadly about what

112
00:04:43,270 --> 00:04:41,280
this looks like

113
00:04:45,430 --> 00:04:43,280

i want to look at any barriers that that

114
00:04:48,070 --> 00:04:45,440
we might face we are government after

115
00:04:49,510 --> 00:04:48,080
all and so uh

116
00:04:51,510 --> 00:04:49,520
with all the goodness that comes with

117
00:04:53,670 --> 00:04:51,520
that we do do have hurdles that we have

118
00:04:56,390 --> 00:04:53,680
to overcome and so how can we creatively

119
00:04:58,550 --> 00:04:56,400
think our way through

120
00:05:00,469 --> 00:04:58,560
adapting with the world that's changing

121
00:05:01,749 --> 00:05:00,479
around us

122
00:05:04,550 --> 00:05:01,759
we'd like to

123
00:05:06,070 --> 00:05:04,560
prioritize and get some next steps

124
00:05:08,629 --> 00:05:06,080
it's important this is

125
00:05:11,510 --> 00:05:08,639
the second of the grand challenge public

126
00:05:13,590 --> 00:05:11,520
conversations that we're really having

127
00:05:15,909 --> 00:05:13,600
we had a great one yesterday around

128
00:05:19,749 --> 00:05:15,919
crowdsourcing and citizen science and

129
00:05:22,710 --> 00:05:20,710
this is

130
00:05:24,469 --> 00:05:22,720
really just the beginning we have a year

131
00:05:27,590 --> 00:05:24,479
ahead of us at least of planning and

132
00:05:29,110 --> 00:05:27,600
co-creating collaboratively designing an

133
00:05:30,950 --> 00:05:29,120
implementation plan for the grand

134
00:05:32,230 --> 00:05:30,960
challenge

135
00:05:34,469 --> 00:05:32,240
and

136
00:05:36,070 --> 00:05:34,479
that's what we

137
00:05:38,790 --> 00:05:36,080
hope to do here

138
00:05:40,070 --> 00:05:38,800

we also have a wiki that we've started

139
00:05:42,710 --> 00:05:40,080
to start

140
00:05:43,749 --> 00:05:42,720
collecting the ideas of the crowd

141
00:05:45,270 --> 00:05:43,759
uh

142
00:05:46,870 --> 00:05:45,280
you can see the

143
00:05:49,909 --> 00:05:46,880
url up there

144
00:05:52,550 --> 00:05:49,919
it's a wiki that you need to get

145
00:05:54,230 --> 00:05:52,560
you need to request access to

146
00:05:55,670 --> 00:05:54,240
but we

147
00:05:59,270 --> 00:05:55,680
welcome you to join us at

148
00:06:04,469 --> 00:06:01,749
to let your voice be heard

149
00:06:07,029 --> 00:06:04,479
in this conversation

150
00:06:07,830 --> 00:06:07,039
additionally uh if you

151
00:06:12,469 --> 00:06:07,840
are

152
00:06:15,189 --> 00:06:12,479
a twitter user hashtag asteroid gc

153
00:06:17,430 --> 00:06:15,199
you can follow the conversation

154
00:06:19,510 --> 00:06:17,440
we hope to see you there

155
00:06:21,590 --> 00:06:19,520
we'll be taking questions

156
00:06:23,670 --> 00:06:21,600
from the world through that means and

157
00:06:25,909 --> 00:06:23,680
joe's got his eyes on

158
00:06:27,670 --> 00:06:25,919
on the internet for us

159
00:06:29,189 --> 00:06:27,680
this morning

160
00:06:31,830 --> 00:06:29,199
so with that

161
00:06:33,590 --> 00:06:31,840
why don't i turn it over to

162
00:06:35,990 --> 00:06:33,600
kevin berry who's joining us from

163
00:06:37,990 --> 00:06:36,000

lifeboat he'll be joining us virtually

164
00:06:40,629 --> 00:06:38,000
he'll have 10 minutes to present and

165
00:06:43,510 --> 00:06:40,639
then i'd like to leave 10 minutes of

166
00:06:45,749 --> 00:06:43,520
questions after he speaks

167
00:06:47,029 --> 00:06:45,759
and so with that kevin

168
00:06:48,710 --> 00:06:47,039
are you with us

169
00:06:50,150 --> 00:06:48,720
i sure am good morning jason good

170
00:06:54,309 --> 00:06:50,160
morning

171
00:06:57,749 --> 00:06:56,550
um is my voice sound level okay you

172
00:06:59,270 --> 00:06:57,759
sound great

173
00:07:01,510 --> 00:06:59,280
almost like you're here with us in

174
00:07:04,070 --> 00:07:01,520
person all right i wish i was

175
00:07:04,950 --> 00:07:04,080
um i wanted to start off this morning by

176
00:07:06,390 --> 00:07:04,960
um

177
00:07:07,749 --> 00:07:06,400
giving the group a little bit of an

178
00:07:10,390 --> 00:07:07,759
overview just a couple minutes on what

179
00:07:12,390 --> 00:07:10,400
the lifeboat foundation's all about um

180
00:07:13,670 --> 00:07:12,400
and i'm not a chart reader so i'll leave

181
00:07:16,870 --> 00:07:13,680
it to your intelligence to read the

182
00:07:18,629 --> 00:07:16,880
actual words on this on the screen

183
00:07:20,309 --> 00:07:18,639
lifeboat is a

184
00:07:21,990 --> 00:07:20,319
it is a non-profit

185
00:07:23,670 --> 00:07:22,000
organization

186
00:07:25,990 --> 00:07:23,680
we have

187
00:07:28,629 --> 00:07:26,000
almost 2500 members

188
00:07:31,189 --> 00:07:28,639

many of whom are fairly significant in

189
00:07:33,029 --> 00:07:31,199
academia and the public

190
00:07:34,469 --> 00:07:33,039
we have nobel prize winners we have a

191
00:07:35,510 --> 00:07:34,479
lot of very popular science fiction

192
00:07:37,189 --> 00:07:35,520
authors

193
00:07:40,230 --> 00:07:37,199
and even a few nasa and contractor

194
00:07:45,749 --> 00:07:42,870
the the foundation is

195
00:07:48,309 --> 00:07:45,759
watching and

196
00:07:50,629 --> 00:07:48,319
attempting to guide in some ways

197
00:07:52,150 --> 00:07:50,639
technological advances we all know the

198
00:07:54,550 --> 00:07:52,160
pace of technology

199
00:07:56,710 --> 00:07:54,560
advance continues to increase

200
00:07:57,990 --> 00:07:56,720
and the kind of risks we're looking at

201
00:07:59,589 --> 00:07:58,000
are the things i think we all worry

202
00:08:01,350 --> 00:07:59,599
about where technology can be used for

203
00:08:03,189 --> 00:08:01,360
good or evil

204
00:08:05,270 --> 00:08:03,199
inadvertently or

205
00:08:06,790 --> 00:08:05,280
maliciously

206
00:08:08,469 --> 00:08:06,800
and

207
00:08:10,230 --> 00:08:08,479
we recognize there's a lot of risks to

208
00:08:12,309 --> 00:08:10,240
both our society and actually our

209
00:08:13,909 --> 00:08:12,319
physical environment based on some of

210
00:08:16,230 --> 00:08:13,919
these technologies

211
00:08:19,670 --> 00:08:16,240
so we have an approach to build what we

212
00:08:22,150 --> 00:08:19,680
call shields which are programs to

213
00:08:24,550 --> 00:08:22,160

shield us from harm including that's

214
00:08:25,909 --> 00:08:24,560
where the asteroid mission

215
00:08:27,670 --> 00:08:25,919
asteroid grand challenge fits in very

216
00:08:30,469 --> 00:08:27,680
nicely and also programs we call

217
00:08:32,630 --> 00:08:30,479
preservers which help us survive

218
00:08:34,709 --> 00:08:32,640
uh these events if they do happen

219
00:08:37,829 --> 00:08:34,719
um we're looking at for example how to

220
00:08:40,310 --> 00:08:37,839
set limitations on nanotechnology um

221
00:08:41,990 --> 00:08:40,320
how to deal with artificial intelligence

222
00:08:44,470 --> 00:08:42,000
space habitats

223
00:08:45,990 --> 00:08:44,480
thus the term lifeboat

224
00:08:47,430 --> 00:08:46,000
how to stabilize and protect the

225
00:08:49,030 --> 00:08:47,440
internet

226
00:08:51,750 --> 00:08:49,040
and of course as i mentioned asteroids

227
00:08:52,790 --> 00:08:51,760
and extraterrestrial challenges

228
00:08:54,949 --> 00:08:52,800
the bottom

229
00:08:57,670 --> 00:08:54,959
word in yellow there the singularity is

230
00:09:00,870 --> 00:08:57,680
kind of a jargon term that's very

231
00:09:03,190 --> 00:09:00,880
well understood in hard science fiction

232
00:09:05,670 --> 00:09:03,200
it's discussing the

233
00:09:08,310 --> 00:09:05,680
the pace of technological intelligence

234
00:09:10,550 --> 00:09:08,320
and the connectivity that we have and

235
00:09:14,230 --> 00:09:10,560
there are a lot of very well

236
00:09:15,030 --> 00:09:14,240
founded non-hysterical studies out there

237
00:09:17,829 --> 00:09:15,040
that

238
00:09:20,710 --> 00:09:17,839

predict and they intersect fairly well

239
00:09:22,150 --> 00:09:20,720
at a position about mid-century

240
00:09:24,230 --> 00:09:22,160
where we may lose the ability to

241
00:09:25,509 --> 00:09:24,240
actually control the intelligence uh

242
00:09:28,790 --> 00:09:25,519
whether you call it a passive

243
00:09:30,949 --> 00:09:28,800
intelligence or an active intelligence

244
00:09:33,190 --> 00:09:30,959
somewhere in the

245
00:09:35,829 --> 00:09:33,200
2045 time frame is where they tend to

246
00:09:39,430 --> 00:09:35,839
center with a span of

247
00:09:41,509 --> 00:09:39,440
to 21 20 so that 100 year span

248
00:09:43,350 --> 00:09:41,519
if you believe the progression and

249
00:09:44,389 --> 00:09:43,360
trending of the models we reach a point

250
00:09:45,829 --> 00:09:44,399
where the

251
00:09:47,430 --> 00:09:45,839
the world's

252
00:09:51,990 --> 00:09:47,440
mechanical intelligence reaches a

253
00:09:56,790 --> 00:09:54,710
did my slide advance there yes it did

254
00:09:59,030 --> 00:09:56,800
all right thank you um

255
00:10:01,430 --> 00:09:59,040
so lifeboat responded to the public

256
00:10:03,030 --> 00:10:01,440
engagement part of the

257
00:10:05,350 --> 00:10:03,040
the nasa challenge

258
00:10:07,509 --> 00:10:05,360
with three a three-pronged approach

259
00:10:09,750 --> 00:10:07,519
telling the story a fabrication

260
00:10:11,750 --> 00:10:09,760
challenge and levering excitement

261
00:10:13,350 --> 00:10:11,760
and because i am both

262
00:10:15,030 --> 00:10:13,360
in the nasa community and hopelessly

263
00:10:18,550 --> 00:10:15,040

linear three prongs got you three

264
00:10:22,310 --> 00:10:19,910
that was an opportunity for everyone to

265
00:10:24,389 --> 00:10:22,320
laugh which i couldn't hear we did

266
00:10:27,350 --> 00:10:24,399
okay good

267
00:10:29,190 --> 00:10:27,360
um the first one uh telling the story

268
00:10:31,030 --> 00:10:29,200
um

269
00:10:33,990 --> 00:10:31,040
the intent of this is to engage the

270
00:10:37,670 --> 00:10:34,000
public in a graduated approach from

271
00:10:41,190 --> 00:10:37,680
passive to active engagement

272
00:10:44,630 --> 00:10:42,710
and home-based both home-based and

273
00:10:46,069 --> 00:10:44,640
school-based means

274
00:10:48,230 --> 00:10:46,079
watching the story what we're talking

275
00:10:50,710 --> 00:10:48,240
about there would be taking both nasa or

276
00:10:52,310 --> 00:10:50,720
partner produced media

277
00:10:55,030 --> 00:10:52,320
whether it's general media that supports

278
00:10:57,750 --> 00:10:55,040
the theme or it's very specific to

279
00:10:59,829 --> 00:10:57,760
the asteroid challenge

280
00:11:02,550 --> 00:10:59,839
also education specific

281
00:11:04,150 --> 00:11:02,560
physics-based math-based science based

282
00:11:07,350 --> 00:11:04,160
and moving that out into the public and

283
00:11:11,430 --> 00:11:08,870
another way we talked about doing this

284
00:11:13,590 --> 00:11:11,440
was using old media for example your

285
00:11:15,910 --> 00:11:13,600
classic science fiction movies or even

286
00:11:19,269 --> 00:11:15,920
the newer science fiction movies and and

287
00:11:21,829 --> 00:11:19,279
leveraging the popularity of those

288
00:11:24,150 --> 00:11:21,839

possibly moving in not just to a passive

289
00:11:25,750 --> 00:11:24,160
watching mode but more of a

290
00:11:27,190 --> 00:11:25,760
what's wrong with this premise what's

291
00:11:31,269 --> 00:11:27,200
what's right and wrong about the physics

292
00:11:34,389 --> 00:11:32,710
the second one making the story now

293
00:11:37,590 --> 00:11:34,399
we're getting into

294
00:11:39,430 --> 00:11:37,600
to active engagement video contests

295
00:11:42,389 --> 00:11:39,440
independent film makers whether they're

296
00:11:45,829 --> 00:11:42,399
sponsored directly or through contests

297
00:11:47,829 --> 00:11:45,839
possibly dedicated youtube channels

298
00:11:51,030 --> 00:11:47,839
film festivals maybe on nasa centers or

299
00:11:53,190 --> 00:11:51,040
near them or virtual film festivals

300
00:11:55,110 --> 00:11:53,200
we discuss social media means to prove

301
00:11:56,949 --> 00:11:55,120
that facebook isn't just all about cute

302
00:12:00,629 --> 00:11:56,959
kittens there's actually cute asteroids

303
00:12:02,870 --> 00:12:00,639
out there or not cute asteroids

304
00:12:04,389 --> 00:12:02,880
contests and games and

305
00:12:07,269 --> 00:12:04,399
journalism story science fiction

306
00:12:09,110 --> 00:12:07,279
contests lifeboat sponsors

307
00:12:11,590 --> 00:12:09,120
does sponsor science fiction contests

308
00:12:13,110 --> 00:12:11,600
and awards

309
00:12:15,509 --> 00:12:13,120
now the third piece of this is where the

310
00:12:17,509 --> 00:12:15,519
real magic happens and the real cost

311
00:12:19,670 --> 00:12:17,519
happens um we're discussing the

312
00:12:22,230 --> 00:12:19,680
possibility of of

313
00:12:24,790 --> 00:12:22,240

an elaborate massively multiplayer

314
00:12:26,629 --> 00:12:24,800
online gaming community

315
00:12:27,509 --> 00:12:26,639
it's rooted in reality it would be tied

316
00:12:30,629 --> 00:12:27,519
to

317
00:12:32,790 --> 00:12:30,639
actual physics asteroid data

318
00:12:34,550 --> 00:12:32,800
streaming in or you know buffered and

319
00:12:36,550 --> 00:12:34,560
delayed

320
00:12:38,629 --> 00:12:36,560
physical constraints would be real tied

321
00:12:39,990 --> 00:12:38,639
to real physics except for time of

322
00:12:41,030 --> 00:12:40,000
course because things happen slowly up

323
00:12:42,310 --> 00:12:41,040
there

324
00:12:43,350 --> 00:12:42,320
um

325
00:12:45,910 --> 00:12:43,360
these

326
00:12:47,590 --> 00:12:45,920
games would require a painful reset like

327
00:12:48,790 --> 00:12:47,600
real life there's no free life you know

328
00:12:51,190 --> 00:12:48,800
you know mario doesn't fall off the

329
00:12:54,150 --> 00:12:51,200
cliff and pop right back up again

330
00:12:56,870 --> 00:12:54,160
um we discussed though

331
00:12:58,949 --> 00:12:56,880
layering on enough bling

332
00:13:00,629 --> 00:12:58,959
whether it's reality based or fantasy

333
00:13:03,110 --> 00:13:00,639
based to really engage the community

334
00:13:05,269 --> 00:13:03,120
whether you're talking about fuel caches

335
00:13:06,629 --> 00:13:05,279
and discoveries in rare metal oil or you

336
00:13:08,389 --> 00:13:06,639
want to bring in aliens you know just

337
00:13:11,430 --> 00:13:08,399
something to engage the public

338
00:13:15,110 --> 00:13:11,440

to meld the fantasy or the

339
00:13:17,269 --> 00:13:15,120
the fantasy and the reality of this

340
00:13:19,430 --> 00:13:17,279
prizes are great

341
00:13:21,269 --> 00:13:19,440
in this case jason because they're free

342
00:13:22,870 --> 00:13:21,279
it would be things like launch passes

343
00:13:25,590 --> 00:13:22,880
center visits

344
00:13:27,030 --> 00:13:25,600
maybe gaming contests at space camps

345
00:13:28,870 --> 00:13:27,040
things like that that don't cost hard

346
00:13:33,670 --> 00:13:28,880
cash but are very attractive to the

347
00:13:36,949 --> 00:13:35,269
the second prong here moves from the

348
00:13:39,590 --> 00:13:36,959
virtual to

349
00:13:41,189 --> 00:13:39,600
the hands-on community

350
00:13:43,750 --> 00:13:41,199
our target demographic here would be the

351
00:13:46,949 --> 00:13:43,760
maker community the maker shops

352
00:13:49,910 --> 00:13:46,959
and fairs your garage inventors

353
00:13:52,389 --> 00:13:49,920
um universities

354
00:13:54,710 --> 00:13:52,399
students at all levels

355
00:13:56,150 --> 00:13:54,720
and the concept here is to

356
00:13:58,790 --> 00:13:56,160
show the public that there's something

357
00:14:00,389 --> 00:13:58,800
real can be done with an asteroid

358
00:14:01,590 --> 00:14:00,399
we discussed a building block approach

359
00:14:03,829 --> 00:14:01,600
from taking

360
00:14:05,990 --> 00:14:03,839
or acquisition and separation

361
00:14:07,829 --> 00:14:06,000
conversion to raw stock conversion to

362
00:14:09,430 --> 00:14:07,839
finish components

363
00:14:11,509 --> 00:14:09,440

and control from

364
00:14:13,269 --> 00:14:11,519
manual hands-on to radio control to

365
00:14:14,790 --> 00:14:13,279
autonomous

366
00:14:16,949 --> 00:14:14,800
this leverages the concept that we see

367
00:14:18,790 --> 00:14:16,959
down here kfc with the lunabotics

368
00:14:20,710 --> 00:14:18,800
challenges also the retrieval challenges

369
00:14:24,710 --> 00:14:20,720
have been great

370
00:14:27,189 --> 00:14:24,720
and it we would want to provide a path

371
00:14:29,829 --> 00:14:27,199
or a development hierarchy technology of

372
00:14:31,829 --> 00:14:29,839
readiness levels from your rube goldberg

373
00:14:32,949 --> 00:14:31,839
you know garage invention to flight like

374
00:14:34,710 --> 00:14:32,959
hardware

375
00:14:36,230 --> 00:14:34,720
and possibly and this is where there is

376
00:14:38,470 --> 00:14:36,240
some money involved

377
00:14:40,230 --> 00:14:38,480
a path from sounding rocket missions to

378
00:14:47,509 --> 00:14:40,240
orbital missions to possibly iss

379
00:14:52,629 --> 00:14:49,509
the third piece of this

380
00:14:54,230 --> 00:14:52,639
is another engagement approach

381
00:14:57,750 --> 00:14:54,240
which is really an adjunct to existing

382
00:15:01,829 --> 00:14:59,750
for example nasa has spotted sponsored

383
00:15:03,670 --> 00:15:01,839
an odyssey the mind program for our

384
00:15:05,590 --> 00:15:03,680
project for years every every year of

385
00:15:06,949 --> 00:15:05,600
the five problems one of them is a nasa

386
00:15:08,870 --> 00:15:06,959
sponsored problem

387
00:15:11,189 --> 00:15:08,880
obviously nasa is heavily involved in

388
00:15:12,710 --> 00:15:11,199

the at the community and agency level on

389
00:15:15,030 --> 00:15:12,720
first robotics

390
00:15:18,230 --> 00:15:15,040
and so the approach here would be for

391
00:15:20,470 --> 00:15:18,240
jason to go to his fellow executives and

392
00:15:26,550 --> 00:15:20,480
persuade them to include asteroid themed

393
00:15:31,269 --> 00:15:28,870
that about wraps up the overview of our

394
00:15:34,310 --> 00:15:31,279
approach and uh jason i guess it's back

395
00:15:36,870 --> 00:15:34,320
to you for questions and answers

396
00:15:41,030 --> 00:15:36,880
thank you so much kevin

397
00:15:43,509 --> 00:15:41,040
joe do we have uh anything coming in yet

398
00:15:44,629 --> 00:15:43,519
okay let me let me start

399
00:15:48,150 --> 00:15:44,639
we have

400
00:15:51,590 --> 00:15:49,590
and jason your audio is a little weak so

401
00:15:53,430 --> 00:15:51,600
i may have to ask you to repeat okay

402
00:15:54,470 --> 00:15:53,440
we're throwing the mic out to the

403
00:15:57,110 --> 00:15:54,480
audience

404
00:15:59,590 --> 00:15:57,120
i was just oh sorry i was just wondering

405
00:16:01,670 --> 00:15:59,600
um do you does lifeboat already have a

406
00:16:04,230 --> 00:16:01,680
relationship with nasa have we done

407
00:16:06,150 --> 00:16:04,240
anything in partnership before

408
00:16:07,910 --> 00:16:06,160
is there something no we haven't

409
00:16:10,150 --> 00:16:07,920
on a formal level we have lots of

410
00:16:11,670 --> 00:16:10,160
memberships engaged in different ways

411
00:16:22,069 --> 00:16:11,680
but we haven't done any actual

412
00:16:25,590 --> 00:16:24,069
kevin how are you uh can you go back to

413
00:16:28,230 --> 00:16:25,600

slide three

414
00:16:29,829 --> 00:16:28,240
absolutely

415
00:16:31,829 --> 00:16:29,839
you're telling the story slide yeah

416
00:16:34,470 --> 00:16:31,839
that's right um so in your last box

417
00:16:36,870 --> 00:16:34,480
living the story one uh where you had um

418
00:16:38,629 --> 00:16:36,880
the piece about uh gay or role-playing

419
00:16:40,710 --> 00:16:38,639
game or any kind of video game with real

420
00:16:43,670 --> 00:16:40,720
data have you looked at partnering with

421
00:16:48,069 --> 00:16:43,680
kerbal space program um and perhaps

422
00:16:50,470 --> 00:16:48,079
doing a an asteroid module with them

423
00:16:52,710 --> 00:16:50,480
no we haven't but that is certainly the

424
00:16:55,269 --> 00:16:52,720
kind of idea that that we like coming

425
00:16:57,030 --> 00:16:55,279
out of this workshop um

426
00:16:58,310 --> 00:16:57,040
jason has my email address so if you'd

427
00:16:59,990 --> 00:16:58,320
like to do a little paragraph on that

428
00:17:05,029 --> 00:17:00,000
and send it to me i'd love to get that

429
00:17:05,039 --> 00:17:10,949
excellent

430
00:17:14,309 --> 00:17:12,630
i'm i'm curious

431
00:17:17,590 --> 00:17:14,319
uh kevin

432
00:17:19,270 --> 00:17:17,600
one of the strengths here is that it's a

433
00:17:20,630 --> 00:17:19,280
very thoughtful

434
00:17:23,510 --> 00:17:20,640
uh

435
00:17:26,949 --> 00:17:23,520
multi-pronged approach

436
00:17:29,830 --> 00:17:26,959
how would you uh anticipate phasing over

437
00:17:32,870 --> 00:17:29,840
time because we're looking at a 10-year

438
00:17:35,350 --> 00:17:32,880

the grand challenge is a 10-year effort

439
00:17:38,549 --> 00:17:35,360
and so what would phasing of

440
00:17:40,630 --> 00:17:38,559
such an ambitious uh program look like

441
00:17:41,990 --> 00:17:40,640
from your perspective

442
00:17:44,630 --> 00:17:42,000
well i'm going to

443
00:17:47,830 --> 00:17:44,640
return the question to you about what's

444
00:17:49,510 --> 00:17:47,840
your budget

445
00:17:51,190 --> 00:17:49,520
because you know justify money is always

446
00:17:53,190 --> 00:17:51,200
the answer to everything

447
00:17:55,190 --> 00:17:53,200
let's assume i would say

448
00:17:57,350 --> 00:17:55,200
in general i've watched the development

449
00:17:59,110 --> 00:17:57,360
of the lunabotics project or luna bodice

450
00:18:01,190 --> 00:17:59,120
competition very closely here at kennedy

451
00:18:03,590 --> 00:18:01,200
space center and it seems like there was

452
00:18:04,710 --> 00:18:03,600
about a three-year curve

453
00:18:06,710 --> 00:18:04,720
to where it really started to get

454
00:18:08,630 --> 00:18:06,720
traction

455
00:18:10,870 --> 00:18:08,640
so i would say

456
00:18:12,310 --> 00:18:10,880
setting aside the actual

457
00:18:14,310 --> 00:18:12,320
gaming or

458
00:18:16,789 --> 00:18:14,320
flight

459
00:18:19,830 --> 00:18:16,799
demonstrations which cost real money and

460
00:18:21,909 --> 00:18:19,840
have real um

461
00:18:24,950 --> 00:18:21,919
constraints in time

462
00:18:26,549 --> 00:18:24,960
i would think you could probably step

463
00:18:28,390 --> 00:18:26,559

each of these up on about two year

464
00:18:31,430 --> 00:18:28,400
increments

465
00:18:34,150 --> 00:18:31,440
okay um so you'd be

466
00:18:35,750 --> 00:18:34,160
one to four or two to four years getting

467
00:18:36,950 --> 00:18:35,760
the easy steps going and then you're

468
00:18:39,990 --> 00:18:36,960
into the tough stuff and you've got to

469
00:18:44,390 --> 00:18:42,710
and in from your experience

470
00:18:46,950 --> 00:18:44,400
uh

471
00:18:48,630 --> 00:18:46,960
getting outside participation whether

472
00:18:52,549 --> 00:18:48,640
it's uh

473
00:18:54,549 --> 00:18:52,559
in-kind or actual uh funding uh

474
00:18:59,750 --> 00:18:54,559
resources

475
00:19:04,150 --> 00:19:01,270
most

476
00:19:06,310 --> 00:19:04,160
of the successes i have seen whether

477
00:19:07,750 --> 00:19:06,320
it's odyssey of the mind first

478
00:19:09,909 --> 00:19:07,760
lunabotics the grand challenge or

479
00:19:12,630 --> 00:19:09,919
whatever are done through high schools

480
00:19:15,590 --> 00:19:12,640
and universities

481
00:19:17,190 --> 00:19:15,600
and the programs seem to be wildly

482
00:19:22,830 --> 00:19:17,200
popular

483
00:19:27,510 --> 00:19:25,430
so the industry side of that is

484
00:19:29,510 --> 00:19:27,520
interesting because budgets are tight

485
00:19:31,270 --> 00:19:29,520
and

486
00:19:32,870 --> 00:19:31,280
i know in the programs i've been engaged

487
00:19:35,350 --> 00:19:32,880
with we've struggled

488
00:19:42,150 --> 00:19:35,360

with less and less industry cash over

489
00:19:45,190 --> 00:19:43,669
and so

490
00:19:47,669 --> 00:19:45,200
did that answer or not answering yeah

491
00:19:49,990 --> 00:19:47,679
and so i'm wondering if because that is

492
00:19:52,630 --> 00:19:50,000
a future you've seen

493
00:19:55,270 --> 00:19:52,640
has that altered uh

494
00:19:57,029 --> 00:19:55,280
model the model that you've looked at or

495
00:19:59,430 --> 00:19:57,039
approaches that you've taken because

496
00:20:01,669 --> 00:19:59,440
you've seen this trend

497
00:20:04,470 --> 00:20:01,679
are there ways of pooling resources

498
00:20:06,630 --> 00:20:04,480
aligning interests such that the the

499
00:20:08,149 --> 00:20:06,640
outcome can still be achieved

500
00:20:10,950 --> 00:20:08,159
but

501
00:20:11,590 --> 00:20:10,960
we're doing it in a different way

502
00:20:21,669 --> 00:20:11,600
i

503
00:20:23,830 --> 00:20:21,679
stem

504
00:20:25,430 --> 00:20:23,840
and corporate presence seems to me to be

505
00:20:27,110 --> 00:20:25,440
converging

506
00:20:29,110 --> 00:20:27,120
even though money is tight on both the

507
00:20:30,789 --> 00:20:29,120
government and the and the

508
00:20:32,870 --> 00:20:30,799
civil side or

509
00:20:33,669 --> 00:20:32,880
business side but i'm seeing more and

510
00:20:34,950 --> 00:20:33,679
more

511
00:20:36,789 --> 00:20:34,960
corporate sponsorships in the

512
00:20:39,110 --> 00:20:36,799
educational world

513
00:20:40,870 --> 00:20:39,120

um not just cash grants but but

514
00:20:43,110 --> 00:20:40,880
associations

515
00:20:44,630 --> 00:20:43,120
so i i think there's something there

516
00:20:46,149 --> 00:20:44,640
until again you start talking about

517
00:20:48,070 --> 00:20:46,159
multi-million dollars for flying

518
00:20:50,470 --> 00:20:48,080
hardware or building you know

519
00:20:52,710 --> 00:20:50,480
server-based games sure that that's the

520
00:20:54,549 --> 00:20:52,720
piece of this i still have some

521
00:20:56,070 --> 00:20:54,559
thoughtful

522
00:20:58,950 --> 00:20:56,080
um

523
00:21:04,789 --> 00:21:01,430
i have i have a question about it sounds

524
00:21:07,029 --> 00:21:04,799
like you have a very large community of

525
00:21:09,029 --> 00:21:07,039
supporters i'm wondering if you can

526
00:21:11,750 --> 00:21:09,039
touch on

527
00:21:14,310 --> 00:21:11,760
some experiences or successes that that

528
00:21:15,990 --> 00:21:14,320
you've had even the failures in terms of

529
00:21:18,630 --> 00:21:16,000
building that community growing that

530
00:21:20,630 --> 00:21:18,640
community is it virtual do you come

531
00:21:22,710 --> 00:21:20,640
together in person

532
00:21:25,190 --> 00:21:22,720
as we start to think about this massive

533
00:21:26,870 --> 00:21:25,200
network of people potentially

534
00:21:28,870 --> 00:21:26,880
interested in

535
00:21:31,990 --> 00:21:28,880
hazardous asteroids because it affects

536
00:21:34,230 --> 00:21:32,000
every single human being on the planet

537
00:21:36,149 --> 00:21:34,240
that's a massive network that we're

538
00:21:38,230 --> 00:21:36,159

talking about and so

539
00:21:41,590 --> 00:21:38,240
how does one start to think about

540
00:21:46,310 --> 00:21:44,789
jason we have seen this it is all about

541
00:21:47,590 --> 00:21:46,320
engaged

542
00:21:49,669 --> 00:21:47,600
leadership

543
00:21:50,950 --> 00:21:49,679
and you know volunteer organizations are

544
00:21:53,270 --> 00:21:50,960
difficult in that they're time

545
00:21:54,870 --> 00:21:53,280
constrained by the people involved

546
00:21:59,990 --> 00:21:54,880
and

547
00:22:02,149 --> 00:22:00,000
do the work we've seen a lot of success

548
00:22:04,230 --> 00:22:02,159
when a

549
00:22:06,789 --> 00:22:04,240
the leader doesn't have the time or the

550
00:22:08,789 --> 00:22:06,799
skills to hold the people together and

551
00:22:11,830 --> 00:22:08,799
drive a timeline

552
00:22:17,110 --> 00:22:11,840
it's been very difficult

553
00:22:20,710 --> 00:22:19,029
if you have volunteer leadership they

554
00:22:22,630 --> 00:22:20,720
have to be able to devote a significant

555
00:22:24,870 --> 00:22:22,640
amount of time to these efforts

556
00:22:27,110 --> 00:22:24,880
if if there's a way to have a kernel of

557
00:22:31,029 --> 00:22:27,120
paid leadership and engage a volunteer

558
00:22:38,630 --> 00:22:33,029
okay

559
00:22:44,390 --> 00:22:41,270
people tend to have preconceived notions

560
00:22:46,310 --> 00:22:44,400
as to what large organizations are about

561
00:22:49,029 --> 00:22:46,320
and what they expect

562
00:22:52,070 --> 00:22:49,039
if an effort is popular because of a

563
00:22:56,070 --> 00:22:52,080

specific organization does that tend to

564
00:22:58,390 --> 00:22:56,080
narrow the range of responses and

565
00:23:02,710 --> 00:22:58,400
what suggestions would you have for how

566
00:23:06,549 --> 00:23:03,430
could

567
00:23:07,270 --> 00:23:06,559
slightly rephrase it i kind of missed

568
00:23:13,430 --> 00:23:07,280
the

569
00:23:15,350 --> 00:23:13,440
if nasa for example is is sponsoring

570
00:23:18,470 --> 00:23:15,360
something and people are going into that

571
00:23:20,149 --> 00:23:18,480
effort or joining it because of that

572
00:23:22,070 --> 00:23:20,159
a lot of people tend to

573
00:23:24,710 --> 00:23:22,080
have a specific idea whether it's true

574
00:23:27,510 --> 00:23:24,720
or not of what they think nasa is so

575
00:23:29,430 --> 00:23:27,520
does that grouping tend to narrow the

576
00:23:33,590 --> 00:23:29,440
range of responses

577
00:23:37,750 --> 00:23:36,149
and and how could you avoid that if one

578
00:23:40,710 --> 00:23:37,760
specific group is drawing all the

579
00:23:45,190 --> 00:23:42,390
i you know

580
00:23:47,190 --> 00:23:45,200
this is all in my in my

581
00:23:48,950 --> 00:23:47,200
experience this is all about building a

582
00:23:50,710 --> 00:23:48,960
framework and a structure

583
00:23:52,230 --> 00:23:50,720
and

584
00:23:53,750 --> 00:23:52,240
this is the eating the elephant one bite

585
00:23:55,909 --> 00:23:53,760
at a time approach which is why i like

586
00:23:58,149 --> 00:23:55,919
the competitions and contests

587
00:24:00,070 --> 00:23:58,159
and projects so well

588
00:24:02,870 --> 00:24:00,080

because near-term it's got a very

589
00:24:03,750 --> 00:24:02,880
well-bounded set of criteria

590
00:24:06,310 --> 00:24:03,760
and

591
00:24:08,710 --> 00:24:06,320
people in general are comfortable within

592
00:24:10,630 --> 00:24:08,720
a rule set or a boundary set

593
00:24:12,549 --> 00:24:10,640
um so the darpa grand challenges and the

594
00:24:15,269 --> 00:24:12,559
nasa grand challenges i think have been

595
00:24:16,630 --> 00:24:15,279
very successful

596
00:24:19,430 --> 00:24:16,640
by setting a

597
00:24:21,029 --> 00:24:19,440
medium-term goal with a desired outcome

598
00:24:21,830 --> 00:24:21,039
and a reward

599
00:24:23,990 --> 00:24:21,840
and

600
00:24:26,070 --> 00:24:24,000
in bounding it with a rule set

601
00:24:27,269 --> 00:24:26,080
um i've been in way like you probably

602
00:24:28,789 --> 00:24:27,279
everyone else i've been in way too many

603
00:24:30,789 --> 00:24:28,799
philosophical discussions about the

604
00:24:32,070 --> 00:24:30,799
witchness of what that you can never

605
00:24:33,510 --> 00:24:32,080
really pin down what you're talking

606
00:24:35,430 --> 00:24:33,520
about

607
00:24:37,029 --> 00:24:35,440
and so if you don't have a tangible

608
00:24:39,190 --> 00:24:37,039
expectation and outcome that that's i

609
00:24:40,390 --> 00:24:39,200
think maybe the

610
00:24:42,230 --> 00:24:40,400
the leverage to make all these things

611
00:24:44,630 --> 00:24:42,240
happen

612
00:24:46,470 --> 00:24:44,640
the question about

613
00:24:49,190 --> 00:24:46,480

you know which of these things are most

614
00:24:51,029 --> 00:24:49,200
important for nasa to contribute and

615
00:24:53,830 --> 00:24:51,039
which things can be done by like the

616
00:24:56,310 --> 00:24:53,840
lifeboat foundation or corporations uh

617
00:24:59,110 --> 00:24:56,320
one is you know you said that things are

618
00:25:02,789 --> 00:24:59,120
popular if they're related to space

619
00:25:05,190 --> 00:25:02,799
and have the nasa brand on it so as nasa

620
00:25:07,190 --> 00:25:05,200
branding okay

621
00:25:08,470 --> 00:25:07,200
nasa may be providing

622
00:25:09,750 --> 00:25:08,480
the

623
00:25:12,630 --> 00:25:09,760
contest

624
00:25:14,710 --> 00:25:12,640
dollars okay for a prize are those

625
00:25:16,630 --> 00:25:14,720
things more important than

626
00:25:20,390 --> 00:25:16,640
a straight funding line and if you're

627
00:25:21,830 --> 00:25:20,400
just given a nasa brand and a nasa prize

628
00:25:23,830 --> 00:25:21,840
can you

629
00:25:26,390 --> 00:25:23,840
get the rest of the funding to do the

630
00:25:29,110 --> 00:25:26,400
things you've listed here

631
00:25:32,070 --> 00:25:29,120
with just that enabling in in these

632
00:25:35,510 --> 00:25:32,080
tight money times is that feasible

633
00:25:39,750 --> 00:25:37,909
i think yes now again i i get to the

634
00:25:43,590 --> 00:25:39,760
point of

635
00:25:45,350 --> 00:25:43,600
i am not a i.t type and i'm not a gamer

636
00:25:47,029 --> 00:25:45,360
type but i have a

637
00:25:49,350 --> 00:25:47,039
i'm a project manager by trade and

638
00:25:52,149 --> 00:25:49,360

program manager i understand how

639
00:25:53,590 --> 00:25:52,159
these projects can go on the on the reef

640
00:25:55,110 --> 00:25:53,600
and i am in the business of launching

641
00:25:56,789 --> 00:25:55,120
things in space and i understand the

642
00:25:59,110 --> 00:25:56,799
expense involved with that and i've i've

643
00:26:00,870 --> 00:25:59,120
worked with students a lot on that

644
00:26:01,990 --> 00:26:00,880
so again i think that

645
00:26:09,110 --> 00:26:02,000
your

646
00:26:11,110 --> 00:26:09,120
of things could be done exactly the way

647
00:26:13,430 --> 00:26:11,120
you say until you cross that threshold

648
00:26:15,430 --> 00:26:13,440
to really get into real hardware and

649
00:26:22,950 --> 00:26:15,440
software that that's where i like i said

650
00:26:27,269 --> 00:26:25,510
i guess i wanted to ask another

651
00:26:30,470 --> 00:26:27,279
questions

652
00:26:32,230 --> 00:26:30,480
this mic is a little bit weird hey um

653
00:26:34,230 --> 00:26:32,240
you made a really interesting comment

654
00:26:36,149 --> 00:26:34,240
about the existing programs the lunar

655
00:26:39,510 --> 00:26:36,159
bots and first

656
00:26:42,870 --> 00:26:39,520
and having them take on asteroid themes

657
00:26:44,710 --> 00:26:42,880
do you do you have any insight into

658
00:26:46,149 --> 00:26:44,720
that actually uh

659
00:26:48,950 --> 00:26:46,159
well especially the lunar bots because

660
00:26:50,549 --> 00:26:48,960
it's right there at kennedy uh do you

661
00:26:53,029 --> 00:26:50,559
that they'd be willing to do something

662
00:26:54,630 --> 00:26:53,039
like that uh and and because they

663
00:26:58,950 --> 00:26:54,640

already have communities already

664
00:27:03,110 --> 00:27:01,510
yes in fact that

665
00:27:04,950 --> 00:27:03,120
miss sawyer here

666
00:27:06,390 --> 00:27:04,960
who i don't know she's the overall you

667
00:27:09,190 --> 00:27:06,400
know program level chair but she's the

668
00:27:10,950 --> 00:27:09,200
implementer here her problem is one of

669
00:27:12,470 --> 00:27:10,960
popularity they've been maxed out for

670
00:27:13,750 --> 00:27:12,480
three they've had this competition for

671
00:27:14,630 --> 00:27:13,760
five years they've been maxed out for

672
00:27:16,310 --> 00:27:14,640
three

673
00:27:18,389 --> 00:27:16,320
they physically don't have the resources

674
00:27:20,470 --> 00:27:18,399
to handle more

675
00:27:21,830 --> 00:27:20,480
than the 50 or so teams they get from

676
00:27:23,110 --> 00:27:21,840
international

677
00:27:25,430 --> 00:27:23,120
um

678
00:27:27,830 --> 00:27:25,440
so i would think

679
00:27:29,110 --> 00:27:27,840
an ad we had thought in terms of an

680
00:27:29,909 --> 00:27:29,120
adjunct

681
00:27:31,750 --> 00:27:29,919
um

682
00:27:34,389 --> 00:27:31,760
for lunabotics in the sense that it

683
00:27:35,430 --> 00:27:34,399
would be a co-competition

684
00:27:37,350 --> 00:27:35,440
which

685
00:27:40,230 --> 00:27:37,360
jason and his program would have to

686
00:27:43,110 --> 00:27:40,240
provide resources to support

687
00:27:45,269 --> 00:27:43,120
now as far as first goes

688
00:27:46,470 --> 00:27:45,279

that's i like that one a lot if you can

689
00:27:50,149 --> 00:27:46,480
if

690
00:27:51,909 --> 00:27:50,159
because first has a problem a single

691
00:27:53,510 --> 00:27:51,919
problem they do every year

692
00:27:59,909 --> 00:27:53,520
and if you could persuade them to use

693
00:28:02,070 --> 00:28:00,710
so

694
00:28:03,590 --> 00:28:02,080
you're saying there's there's actually a

695
00:28:06,549 --> 00:28:03,600
really successful

696
00:28:08,230 --> 00:28:06,559
nasa-based program that limits the

697
00:28:10,149 --> 00:28:08,240
number of participants because of

698
00:28:11,990 --> 00:28:10,159
funding or resources

699
00:28:13,510 --> 00:28:12,000
yeah doesn't that seem like a really

700
00:28:14,789 --> 00:28:13,520
interesting problem to solve on the way

701
00:28:16,470 --> 00:28:14,799
to create trying to create an even

702
00:28:18,389 --> 00:28:16,480
larger community

703
00:28:20,549 --> 00:28:18,399
oh absolutely and i know they would love

704
00:28:22,710 --> 00:28:20,559
to be able to handle from a facility and

705
00:28:24,470 --> 00:28:22,720
a funding standpoint a bigger a bigger

706
00:28:25,510 --> 00:28:24,480
crowd this is a wildly popular they hold

707
00:28:28,070 --> 00:28:25,520
it in the rocket garden here at the

708
00:28:30,149 --> 00:28:28,080
visitor center

709
00:28:31,029 --> 00:28:30,159
and it's very well supported it just

710
00:28:32,470 --> 00:28:31,039
takes

711
00:28:34,470 --> 00:28:32,480
like i said earlier my little

712
00:28:36,870 --> 00:28:34,480
catchphrase would just supply money

713
00:28:38,789 --> 00:28:36,880

um i really think it's a it's a possible

714
00:28:40,549 --> 00:28:38,799
avenue and it's related to lunar mining

715
00:28:45,510 --> 00:28:40,559
which is certainly closely

716
00:28:51,830 --> 00:28:46,870
and i know the retrieval challenge up

717
00:28:54,870 --> 00:28:53,110
i think they're about a year behind on

718
00:28:59,750 --> 00:28:54,880
the on the curve but they're very very

719
00:29:04,149 --> 00:29:01,669
do we have any other questions in the

720
00:29:07,590 --> 00:29:04,159
audience

721
00:29:11,909 --> 00:29:10,070
thank you kevin

722
00:29:13,510 --> 00:29:11,919
thank you jason i do have to drop off

723
00:29:15,669 --> 00:29:13,520
but i look forward to more communication

724
00:29:17,269 --> 00:29:15,679
and seeing you the next time you're down

725
00:29:18,789 --> 00:29:17,279
ben thanks for planting some good seeds

726
00:29:26,470 --> 00:29:18,799
with us

727
00:29:33,990 --> 00:29:29,590
all right next up we have david delgado

728
00:29:40,549 --> 00:29:36,310
clicker

729
00:29:44,630 --> 00:29:43,110
hello everyone um

730
00:29:47,269 --> 00:29:44,640
really nice to be here my name is david

731
00:29:49,029 --> 00:29:47,279
delgado and um i'm here to talk a little

732
00:29:51,110 --> 00:29:49,039
bit about

733
00:29:52,789 --> 00:29:51,120
two tools that

734
00:29:54,549 --> 00:29:52,799
are existing tools

735
00:29:57,350 --> 00:29:54,559
eyes on the solar system

736
00:30:00,950 --> 00:29:57,360
and asteroid watch and

737
00:30:04,630 --> 00:30:00,960
potential ways to enhance these tools

738
00:30:06,389 --> 00:30:04,640

to really sort of deepen the

739
00:30:08,789 --> 00:30:06,399
the interest of people who are already

740
00:30:11,669 --> 00:30:08,799
participating with them in relationship

741
00:30:13,750 --> 00:30:11,679
to near-earth asteroids but also broaden

742
00:30:15,269 --> 00:30:13,760
the reach of people who are working with

743
00:30:16,710 --> 00:30:15,279
us so we can

744
00:30:18,070 --> 00:30:16,720
you know bring more people into the

745
00:30:20,070 --> 00:30:18,080
community

746
00:30:21,510 --> 00:30:20,080
these tools have been proven to be

747
00:30:24,870 --> 00:30:21,520
really powerful in the areas of

748
00:30:27,350 --> 00:30:24,880
visualization and in communication and

749
00:30:28,710 --> 00:30:27,360
so our proposal was based on different

750
00:30:30,230 --> 00:30:28,720
ways to

751
00:30:31,909 --> 00:30:30,240
sort of bring new

752
00:30:35,510 --> 00:30:31,919
new things to these

753
00:30:39,430 --> 00:30:37,510
first i'd like to go into eyes on the

754
00:30:42,149 --> 00:30:39,440
solar system and and what we're seeing

755
00:30:44,549 --> 00:30:42,159
here is a visualization um this eyes on

756
00:30:47,269 --> 00:30:44,559
the solar system is a 3d map running on

757
00:30:48,310 --> 00:30:47,279
a game engine um that allows you to

758
00:30:51,590 --> 00:30:48,320
explore

759
00:30:54,389 --> 00:30:51,600
uh the solar system um through 1950 to

760
00:30:55,269 --> 00:30:54,399
2050 you can click on any label and go

761
00:30:57,110 --> 00:30:55,279
to that

762
00:30:58,710 --> 00:30:57,120
that flexibility and time allows you to

763
00:31:01,430 --> 00:30:58,720

do things like go back in time here we

764
00:31:03,909 --> 00:31:01,440
are in 2004 and we're looking at the

765
00:31:05,750 --> 00:31:03,919
cassini spacecraft as it

766
00:31:08,710 --> 00:31:05,760
arrives to saturn now this is

767
00:31:11,029 --> 00:31:08,720
reconstructed engineering data and so

768
00:31:11,990 --> 00:31:11,039
what you see is actually what happened

769
00:31:15,190 --> 00:31:12,000
um

770
00:31:16,870 --> 00:31:15,200
and uh you know we can add some visual

771
00:31:18,549 --> 00:31:16,880
controls here pull way back you see the

772
00:31:21,190 --> 00:31:18,559
constellations

773
00:31:23,590 --> 00:31:21,200
pull even farther back and see some of

774
00:31:24,470 --> 00:31:23,600
our farthest out spacecraft

775
00:31:26,310 --> 00:31:24,480
and

776
00:31:27,909 --> 00:31:26,320
this is zooming way in

777
00:31:30,310 --> 00:31:27,919
back to earth

778
00:31:31,990 --> 00:31:30,320
turning off the visual controls

779
00:31:33,990 --> 00:31:32,000
so that we can get a more photorealistic

780
00:31:37,669 --> 00:31:34,000
view of earth

781
00:31:40,789 --> 00:31:37,679
and its correct position in space

782
00:31:44,389 --> 00:31:40,799
um we have already included uh uh

783
00:31:46,470 --> 00:31:44,399
multiple a few dozen asteroids um and

784
00:31:48,630 --> 00:31:46,480
comets into the system of eyes on the

785
00:31:49,909 --> 00:31:48,640
solar system um some of the most popular

786
00:31:52,149 --> 00:31:49,919
ones and some of that have been

787
00:31:54,149 --> 00:31:52,159
considered the most explorable

788
00:31:55,909 --> 00:31:54,159

here we're looking at vesta

789
00:31:59,110 --> 00:31:55,919
with the shape model provided by the

790
00:32:00,149 --> 00:31:59,120
dawn spacecraft the data or you can um

791
00:32:03,350 --> 00:32:00,159
you know because we have that

792
00:32:04,230 --> 00:32:03,360
flexibility of 100 years go back in time

793
00:32:06,230 --> 00:32:04,240
and

794
00:32:08,230 --> 00:32:06,240
look at the year 2000

795
00:32:10,389 --> 00:32:08,240
here we'll zoom into the near spacecraft

796
00:32:11,830 --> 00:32:10,399
as it orbits the aeros

797
00:32:13,430 --> 00:32:11,840
asteroid

798
00:32:15,590 --> 00:32:13,440
you can do kind of cool things where you

799
00:32:17,430 --> 00:32:15,600
can lock on to specific things either

800
00:32:19,190 --> 00:32:17,440
the asteroid or the comet or the

801
00:32:21,590 --> 00:32:19,200
spacecraft here we're locking onto the

802
00:32:24,230 --> 00:32:21,600
near spacecraft and you can see what it

803
00:32:27,029 --> 00:32:24,240
sees at that time

804
00:32:29,350 --> 00:32:27,039
pull back and look at the solar system

805
00:32:32,389 --> 00:32:29,360
all of the various labels turn those off

806
00:32:35,029 --> 00:32:32,399
and see a variety of different asteroid

807
00:32:38,070 --> 00:32:35,039
paths in the solar system

808
00:32:39,750 --> 00:32:38,080
these are just a few of a very brief

809
00:32:42,549 --> 00:32:39,760
overview of the capabilities of eyes on

810
00:32:44,870 --> 00:32:42,559
the solar system and

811
00:32:46,310 --> 00:32:44,880
just wanted to go over that briefly so

812
00:32:48,470 --> 00:32:46,320
we can talk about

813
00:32:50,630 --> 00:32:48,480

ways to enhance those things also wanted

814
00:32:53,269 --> 00:32:50,640
to bring up asteroid watch now asteroid

815
00:32:55,990 --> 00:32:53,279
watch has been very good at

816
00:32:58,149 --> 00:32:56,000
communicating to people out there

817
00:33:00,149 --> 00:32:58,159
about the potential risk of

818
00:33:02,389 --> 00:33:00,159
near-earth asteroids i'm sure a lot of

819
00:33:04,389 --> 00:33:02,399
you are familiar with this

820
00:33:06,230 --> 00:33:04,399
and i wanted to bring up uh just this

821
00:33:07,269 --> 00:33:06,240
twitter page there's this twitter

822
00:33:10,470 --> 00:33:07,279
account

823
00:33:12,230 --> 00:33:10,480
that has a really big community and um

824
00:33:14,310 --> 00:33:12,240
this is a community that's actively

825
00:33:18,710 --> 00:33:14,320
engaged they're listening they want to

826
00:33:20,549 --> 00:33:18,720
know about asteroids but we think that

827
00:33:23,110 --> 00:33:20,559
there's a lot of ways to

828
00:33:25,909 --> 00:33:23,120
bring more people in and we wanted to

829
00:33:28,149 --> 00:33:25,919
think about new ways new activities to

830
00:33:29,909 --> 00:33:28,159
sort of broaden that group and bring

831
00:33:32,950 --> 00:33:29,919
people who don't normally think about

832
00:33:34,870 --> 00:33:32,960
these things into the community of

833
00:33:37,669 --> 00:33:34,880
near-earth asteroids

834
00:33:39,509 --> 00:33:37,679
sometimes we get free advertising

835
00:33:41,830 --> 00:33:39,519
and this is an image that you've all

836
00:33:43,430 --> 00:33:41,840
seen many many times obviously but

837
00:33:44,870 --> 00:33:43,440
i wanted to show this there's a lot of

838
00:33:45,909 --> 00:33:44,880

reasons to talk about this specific

839
00:33:48,870 --> 00:33:45,919
event

840
00:33:50,950 --> 00:33:48,880
for exactly what happened but this was

841
00:33:52,470 --> 00:33:50,960
interesting because of the timing of

842
00:33:53,750 --> 00:33:52,480
when it happened

843
00:33:57,110 --> 00:33:53,760
this happened

844
00:34:00,310 --> 00:33:57,120
just you know hours before the larger

845
00:34:03,990 --> 00:34:00,320
um near earth asteroid da14

846
00:34:05,590 --> 00:34:04,000
created a was near pass by earth and

847
00:34:06,630 --> 00:34:05,600
that was really interesting because this

848
00:34:09,030 --> 00:34:06,640
event

849
00:34:10,869 --> 00:34:09,040
um obviously had a lot of media

850
00:34:12,869 --> 00:34:10,879
attention and nearly three hundred

851
00:34:16,069 --> 00:34:12,879
thousand people went to eyes on the

852
00:34:18,710 --> 00:34:16,079
solar system for the da14 passport to

853
00:34:21,669 --> 00:34:18,720
watch the real-time visualization

854
00:34:24,310 --> 00:34:21,679
of that uh near earth earth asteroid

855
00:34:27,589 --> 00:34:24,320
passed by earth and because eyes on the

856
00:34:29,270 --> 00:34:27,599
solar system is a 3d map

857
00:34:31,430 --> 00:34:29,280
that can go backwards and forwards in

858
00:34:34,950 --> 00:34:31,440
time that visualizes things that you

859
00:34:36,149 --> 00:34:34,960
can't see necessarily like the da14 pass

860
00:34:38,710 --> 00:34:36,159
by

861
00:34:40,149 --> 00:34:38,720
that is makes it a really good tool for

862
00:34:43,270 --> 00:34:40,159
telling stories

863
00:34:44,550 --> 00:34:43,280

and um to tell visual storage stories

864
00:34:45,990 --> 00:34:44,560
and so

865
00:34:48,389 --> 00:34:46,000
um

866
00:34:49,909 --> 00:34:48,399
we wanted to just think about what you

867
00:34:51,270 --> 00:34:49,919
could do with that

868
00:34:52,629 --> 00:34:51,280
if you could

869
00:34:55,030 --> 00:34:52,639
um

870
00:34:57,829 --> 00:34:55,040
just start with simple things

871
00:34:59,190 --> 00:34:57,839
from simple going to sophisticated

872
00:35:00,710 --> 00:34:59,200
um

873
00:35:03,109 --> 00:35:00,720
what are asteroids you know a lot of

874
00:35:05,030 --> 00:35:03,119
people if we want to bring in a larger

875
00:35:06,630 --> 00:35:05,040
community some people don't think about

876
00:35:10,150 --> 00:35:06,640
these things so let's start with the

877
00:35:12,950 --> 00:35:10,160
basics what are near-earth asteroids um

878
00:35:15,430 --> 00:35:12,960
which ones are considered dangerous

879
00:35:18,150 --> 00:35:15,440
now which are have the um maybe we could

880
00:35:20,150 --> 00:35:18,160
take a tour of the solar system and look

881
00:35:22,790 --> 00:35:20,160
at earth and moon and mars and look at

882
00:35:24,630 --> 00:35:22,800
the impacts that asteroids had and which

883
00:35:26,470 --> 00:35:24,640
ones are the most interesting which ones

884
00:35:29,589 --> 00:35:26,480
are the largest let's compare those

885
00:35:31,990 --> 00:35:29,599
things um maybe we can

886
00:35:34,950 --> 00:35:32,000
pre-visualize or do more sophisticated

887
00:35:36,550 --> 00:35:34,960
things like pre-visualize

888
00:35:40,230 --> 00:35:36,560

asteroid encounters

889
00:35:41,910 --> 00:35:40,240
maybe redirection concepts this idea to

890
00:35:43,910 --> 00:35:41,920
look forward in time is also an

891
00:35:45,910 --> 00:35:43,920
interesting capability where we can

892
00:35:47,750 --> 00:35:45,920
think about how things may happen in the

893
00:35:49,670 --> 00:35:47,760
future and visualize those things so we

894
00:35:52,470 --> 00:35:49,680
can get people interested in what may

895
00:35:57,030 --> 00:35:55,030
also bringing in more data into eyes on

896
00:35:59,829 --> 00:35:57,040
the solar system will just allow more

897
00:36:02,230 --> 00:35:59,839
people to be more interested um

898
00:36:03,589 --> 00:36:02,240
if you uh

899
00:36:07,190 --> 00:36:03,599
of course we'd love to bring in the full

900
00:36:08,230 --> 00:36:07,200
catalog of the um asteroid data into as

901
00:36:10,230 --> 00:36:08,240
in the solar system which would be

902
00:36:12,630 --> 00:36:10,240
incredibly interesting but also add

903
00:36:13,670 --> 00:36:12,640
multiple levels of data

904
00:36:16,870 --> 00:36:13,680
like

905
00:36:19,030 --> 00:36:16,880
size mask the risk of impact estimated

906
00:36:20,790 --> 00:36:19,040
value and allows people to interact with

907
00:36:22,069 --> 00:36:20,800
that data in ways that they're not able

908
00:36:23,990 --> 00:36:22,079
to now

909
00:36:25,510 --> 00:36:24,000
what if they could have user

910
00:36:27,109 --> 00:36:25,520
functionality

911
00:36:29,430 --> 00:36:27,119
to allow people to tag their favorite

912
00:36:32,310 --> 00:36:29,440
astor asteroids or why or follow them

913
00:36:34,470 --> 00:36:32,320

over time or potentially even rate them

914
00:36:36,710 --> 00:36:34,480
so that over time we can see

915
00:36:41,109 --> 00:36:36,720
which asteroids are of greatest interest

916
00:36:42,870 --> 00:36:41,119
to a large population of people

917
00:36:44,550 --> 00:36:42,880
and

918
00:36:46,630 --> 00:36:44,560
another

919
00:36:49,109 --> 00:36:46,640
idea was sort of thinking about

920
00:36:50,950 --> 00:36:49,119
you know sometimes seeing is believing

921
00:36:52,390 --> 00:36:50,960
and i just think that

922
00:36:55,030 --> 00:36:52,400
if we could see

923
00:36:57,430 --> 00:36:55,040
the amount of near-earth asteroids and

924
00:36:58,870 --> 00:36:57,440
earth objects that are around us

925
00:37:01,030 --> 00:36:58,880
i don't think we would have any problem

926
00:37:02,870 --> 00:37:01,040
of raising interest one of the things is

927
00:37:04,790 --> 00:37:02,880
is that you sort of have to be at a

928
00:37:07,270 --> 00:37:04,800
certain level of interest and have a

929
00:37:09,430 --> 00:37:07,280
certain level of passion to participate

930
00:37:11,910 --> 00:37:09,440
in the citizen science and and

931
00:37:13,670 --> 00:37:11,920
crowdsourcing projects that are already

932
00:37:15,910 --> 00:37:13,680
out there

933
00:37:17,670 --> 00:37:15,920
but a lot of people aren't there yet but

934
00:37:21,190 --> 00:37:17,680
what if we could show them

935
00:37:22,630 --> 00:37:21,200
through augmented reality apps like this

936
00:37:24,790 --> 00:37:22,640
and there's certain things that that

937
00:37:26,870 --> 00:37:24,800
exist out there using certain tech now

938
00:37:28,790 --> 00:37:26,880

similar technologies like sun trackers

939
00:37:30,630 --> 00:37:28,800
and things where you can look at the sky

940
00:37:31,670 --> 00:37:30,640
from your position

941
00:37:33,750 --> 00:37:31,680
and

942
00:37:38,790 --> 00:37:33,760
see things that are there but you can't

943
00:37:42,950 --> 00:37:40,310
using eyes on the solar system

944
00:37:45,030 --> 00:37:42,960
capabilities moving things in fast time

945
00:37:46,870 --> 00:37:45,040
right that would add sort of the drama

946
00:37:48,550 --> 00:37:46,880
of seeing things more quickly or

947
00:37:50,470 --> 00:37:48,560
seeing it in real time

948
00:37:52,390 --> 00:37:50,480
where you could access some of the data

949
00:37:54,150 --> 00:37:52,400
like i just talked about

950
00:37:55,750 --> 00:37:54,160
knowing what they're called

951
00:37:57,990 --> 00:37:55,760
what their mass is their you know

952
00:37:59,910 --> 00:37:58,000
potential risk of impact all of those

953
00:38:02,310 --> 00:37:59,920
things just being able to see those

954
00:38:05,829 --> 00:38:02,320
things more clearly will open up sort of

955
00:38:08,390 --> 00:38:05,839
a wider range or sort of an easier point

956
00:38:10,069 --> 00:38:08,400
of entry for people to sort of start

957
00:38:13,589 --> 00:38:10,079
thinking about these things and they

958
00:38:16,069 --> 00:38:13,599
will just be more available to us

959
00:38:18,230 --> 00:38:16,079
and um yeah we actually we spent a long

960
00:38:20,150 --> 00:38:18,240
time talking about citizen science and

961
00:38:21,829 --> 00:38:20,160
crowdsourcing so i'm not going to go

962
00:38:23,750 --> 00:38:21,839
into this we did a great job of talking

963
00:38:25,190 --> 00:38:23,760

about it yesterday

964
00:38:27,270 --> 00:38:25,200
but i did want to talk a little bit

965
00:38:28,630 --> 00:38:27,280
about creating games

966
00:38:34,069 --> 00:38:28,640
and

967
00:38:37,349 --> 00:38:34,079
have fun you're thinking um you know

968
00:38:40,470 --> 00:38:37,359
it would just be fun to take

969
00:38:41,910 --> 00:38:40,480
loved games like this and and bring in

970
00:38:44,790 --> 00:38:41,920
some real data

971
00:38:46,950 --> 00:38:44,800
and bring in some just the capability to

972
00:38:49,190 --> 00:38:46,960
have a little bit of fun and learn learn

973
00:38:50,870 --> 00:38:49,200
a little bit about

974
00:38:53,270 --> 00:38:50,880
asteroids and earth asteroids and the

975
00:38:54,870 --> 00:38:53,280
potential risks i mean imagining with

976
00:38:56,790 --> 00:38:54,880
something like this you're not going to

977
00:38:58,230 --> 00:38:56,800
learn a huge amount but it's one of

978
00:39:00,710 --> 00:38:58,240
those things where we're talking like an

979
00:39:02,150 --> 00:39:00,720
entry level multiple points of access

980
00:39:05,750 --> 00:39:02,160
yesterday when we were talking about

981
00:39:07,430 --> 00:39:05,760
citizen science and uh crowdsourcing uh

982
00:39:09,030 --> 00:39:07,440
one of the questions that came up for me

983
00:39:10,870 --> 00:39:09,040
are what are the potential barriers for

984
00:39:14,550 --> 00:39:10,880
people getting involved with this and i

985
00:39:17,030 --> 00:39:14,560
think um you know you have to sort of be

986
00:39:19,430 --> 00:39:17,040
uh in the group already or have a

987
00:39:21,750 --> 00:39:19,440
certain level of passion and skills to

988
00:39:24,790 --> 00:39:21,760

be able to participate in these things

989
00:39:27,430 --> 00:39:24,800
well um i think the time is right to

990
00:39:29,910 --> 00:39:27,440
really open up multiple levels of entry

991
00:39:32,310 --> 00:39:29,920
so that you know even if it's a fun sort

992
00:39:35,589 --> 00:39:32,320
of participation level like this it

993
00:39:37,190 --> 00:39:35,599
might uh serve as a as an easy way to

994
00:39:39,349 --> 00:39:37,200
get people in the door

995
00:39:41,750 --> 00:39:39,359
thinking about real data that this is

996
00:39:44,069 --> 00:39:41,760
being powered by real data and

997
00:39:47,030 --> 00:39:44,079
help them move upward into higher levels

998
00:39:50,310 --> 00:39:47,040
of participation

999
00:39:52,310 --> 00:39:50,320
and uh and so that's sort of that's

1000
00:39:54,790 --> 00:39:52,320
wraps it up for me but i think that you

1001
00:39:57,349 --> 00:39:54,800
know using these tools to engage the

1002
00:39:59,349 --> 00:39:57,359
the people that we already participating

1003
00:40:00,150 --> 00:39:59,359
creating new tools to bring more people

1004
00:40:02,069 --> 00:40:00,160
in

1005
00:40:03,430 --> 00:40:02,079
at sort of earlier levels and sort of

1006
00:40:05,990 --> 00:40:03,440
multiple

1007
00:40:08,630 --> 00:40:06,000
points of entry

1008
00:40:11,270 --> 00:40:08,640
bringing in more data more access to

1009
00:40:12,790 --> 00:40:11,280
different layers of data and

1010
00:40:15,030 --> 00:40:12,800
making some fun

1011
00:40:31,430 --> 00:40:15,040
games out of it would be a great way to

1012
00:40:35,030 --> 00:40:33,190
that's a just a great idea i mean an

1013
00:40:35,910 --> 00:40:35,040

asteroids game based on real asteroid

1014
00:40:37,510 --> 00:40:35,920
data

1015
00:40:39,109 --> 00:40:37,520
or the ability to hold up your

1016
00:40:40,790 --> 00:40:39,119
smartphone and actually see what near

1017
00:40:42,390 --> 00:40:40,800
earth asteroids are there is very cool

1018
00:40:43,990 --> 00:40:42,400
but how about eyes on the solar system

1019
00:40:46,230 --> 00:40:44,000
is kind of even a

1020
00:40:47,670 --> 00:40:46,240
observation planning kind of tool for

1021
00:40:49,750 --> 00:40:47,680
the minor planet center some of these

1022
00:40:52,390 --> 00:40:49,760
asteroid observations where you could

1023
00:40:54,069 --> 00:40:52,400
create kind of uh you know

1024
00:40:56,390 --> 00:40:54,079
ellipsoids of uncertainty or other

1025
00:40:58,870 --> 00:40:56,400
things and kind of show the improvement

1026
00:41:00,870 --> 00:40:58,880
to the um you know the asteroid orbit

1027
00:41:03,190 --> 00:41:00,880
model or other things as additional data

1028
00:41:04,630 --> 00:41:03,200
comes in no i think that's a great idea

1029
00:41:07,430 --> 00:41:04,640
i think it's a great idea yeah it's a

1030
00:41:09,670 --> 00:41:07,440
really versatile tool um the flexibility

1031
00:41:13,589 --> 00:41:09,680
in time uh over that hundred year period

1032
00:41:15,670 --> 00:41:13,599
from 1950 to 2050 and um the ability to

1033
00:41:18,870 --> 00:41:15,680
pre-visualize things i mean it's just a

1034
00:41:20,470 --> 00:41:18,880
tremendous amount of flexibility in that

1035
00:41:26,710 --> 00:41:20,480
in that tool and and i think something

1036
00:41:29,589 --> 00:41:27,670
yeah

1037
00:41:32,710 --> 00:41:29,599
just something to

1038
00:41:34,950 --> 00:41:32,720

go out to the asteroid belt you can

1039
00:41:36,309 --> 00:41:34,960
stand on any one of those asteroids and

1040
00:41:38,150 --> 00:41:36,319
not see

1041
00:41:41,589 --> 00:41:38,160
another asteroid unless you're on a

1042
00:41:43,270 --> 00:41:41,599
binary or a turn area type body

1043
00:41:46,390 --> 00:41:43,280
another thing to bear in mind

1044
00:41:49,349 --> 00:41:46,400
i'm all for public engagement and more

1045
00:41:52,069 --> 00:41:49,359
but you need big glass to find the stuff

1046
00:41:54,870 --> 00:41:52,079
that uh nasa wants to find

1047
00:41:56,870 --> 00:41:54,880
uh we're talking three meter class type

1048
00:41:58,630 --> 00:41:56,880
ground-based instruments to find the

1049
00:42:00,790 --> 00:41:58,640
small stuff or space-based instruments

1050
00:42:03,670 --> 00:42:00,800
and those are things that the public who

1051
00:42:05,510 --> 00:42:03,680
are crowdsourcing probably cannot likely

1052
00:42:07,910 --> 00:42:05,520
finance i mean

1053
00:42:09,829 --> 00:42:07,920
the movie iron sky was financed via

1054
00:42:12,710 --> 00:42:09,839
crowdsourcing and so on

1055
00:42:16,069 --> 00:42:12,720
uh it's an interesting sci-fi flick but

1056
00:42:16,790 --> 00:42:16,079
we're talking big money big science uh

1057
00:42:21,990 --> 00:42:16,800
in

1058
00:42:23,430 --> 00:42:22,000
uh access to you know that big science

1059
00:42:25,349 --> 00:42:23,440
we're talking half a billion dollars or

1060
00:42:26,790 --> 00:42:25,359
tens of millions of dollars type of a

1061
00:42:28,309 --> 00:42:26,800
thing so

1062
00:42:31,349 --> 00:42:28,319
just i think it's important also bear in

1063
00:42:32,950 --> 00:42:31,359

mind a reality check on that you can be

1064
00:42:34,550 --> 00:42:32,960
on any neo

1065
00:42:37,510 --> 00:42:34,560
and not see another one unless you're in

1066
00:42:39,750 --> 00:42:37,520
a binary or trinary type body

1067
00:42:41,510 --> 00:42:39,760
yeah um thanks i i think you um are you

1068
00:42:42,790 --> 00:42:41,520
maybe referring to the last slide of the

1069
00:42:46,470 --> 00:42:42,800
asteroids game

1070
00:42:48,550 --> 00:42:46,480
so actually the whole yeah

1071
00:42:51,030 --> 00:42:48,560
i love the eyes on the solar system

1072
00:42:52,390 --> 00:42:51,040
regrettably only goes back to 1950. they

1073
00:42:53,829 --> 00:42:52,400
tell another interesting story if you

1074
00:42:56,309 --> 00:42:53,839
want to tell the asteroid story take it

1075
00:42:57,109 --> 00:42:56,319
back to 1801 when astronomers are trying

1076
00:43:00,069 --> 00:42:57,119
to

1077
00:43:02,790 --> 00:43:00,079
really understand the tedious abode law

1078
00:43:05,190 --> 00:43:02,800
uh and where was the planet between mars

1079
00:43:07,349 --> 00:43:05,200
and jupiter and discovery of ceres a

1080
00:43:09,109 --> 00:43:07,359
handful more asteroids made by asteroids

1081
00:43:10,950 --> 00:43:09,119
by olbers and so on and then there's

1082
00:43:14,550 --> 00:43:10,960
another flux and asteroid discovery in

1083
00:43:16,150 --> 00:43:14,560
the 1840s and then the first neo which

1084
00:43:19,750 --> 00:43:16,160
you actually showed here

1085
00:43:22,069 --> 00:43:19,760
433 eros was discovered in 1898 and then

1086
00:43:23,750 --> 00:43:22,079
the sudden flood of things that come in

1087
00:43:25,430 --> 00:43:23,760
but the dots representing those

1088
00:43:27,589 --> 00:43:25,440

asteroids would not be the scale it'd

1089
00:43:28,950 --> 00:43:27,599
give a false impression wow oh yeah out

1090
00:43:31,750 --> 00:43:28,960
of the space so yeah but there's a lot

1091
00:43:33,510 --> 00:43:31,760
of space between that but you see a

1092
00:43:35,349 --> 00:43:33,520
quite a logarithmic

1093
00:43:38,470 --> 00:43:35,359
rise in the discovery right especially

1094
00:43:40,390 --> 00:43:38,480
in 1998 when uh nasa takes on the the

1095
00:43:42,470 --> 00:43:40,400
goal of uh

1096
00:43:46,069 --> 00:43:42,480
the any observations program was created

1097
00:43:49,190 --> 00:43:46,079
and to find these things um but

1098
00:43:51,829 --> 00:43:49,200
that's probably overwhelms uh the system

1099
00:43:53,910 --> 00:43:51,839
uh the folks at arma observatory have

1100
00:43:56,309 --> 00:43:53,920
done great visualization data

1101
00:43:58,710 --> 00:43:56,319
visualization and the folks at pan stars

1102
00:44:00,630 --> 00:43:58,720
as well to show how kind of crowded it

1103
00:44:03,430 --> 00:44:00,640
is but those dots representing those

1104
00:44:05,270 --> 00:44:03,440
neos are not to scale at all yeah yeah

1105
00:44:07,430 --> 00:44:05,280
yeah yeah i know i think you're right

1106
00:44:11,030 --> 00:44:07,440
yeah um i think that specifically not to

1107
00:44:14,309 --> 00:44:11,040
scale when i was talking about the um

1108
00:44:16,390 --> 00:44:14,319
the uh augmentation app uh visualization

1109
00:44:18,309 --> 00:44:16,400
but um

1110
00:44:19,910 --> 00:44:18,319
if you can just imagine what would it

1111
00:44:21,430 --> 00:44:19,920
look like i mean at real scale you know

1112
00:44:23,910 --> 00:44:21,440
if you could if you could look at the

1113
00:44:25,670 --> 00:44:23,920

sky and just see the full

1114
00:44:27,430 --> 00:44:25,680
catalog of everything we've discovered

1115
00:44:29,829 --> 00:44:27,440
so far and need to look 10 years into

1116
00:44:31,750 --> 00:44:29,839
the future and see what's actually been

1117
00:44:34,230 --> 00:44:31,760
discovered then

1118
00:44:35,030 --> 00:44:34,240
then identified there's a lot out there

1119
00:44:36,230 --> 00:44:35,040
and

1120
00:44:37,750 --> 00:44:36,240
um uh

1121
00:44:39,670 --> 00:44:37,760
i guess my point was just wondering like

1122
00:44:42,230 --> 00:44:39,680
if you could if it if they weren't so

1123
00:44:44,069 --> 00:44:42,240
hard to see i think it would be a lot

1124
00:44:46,470 --> 00:44:44,079
easier to get people engaged in thinking

1125
00:44:48,950 --> 00:44:46,480
about what's actually going on yeah

1126
00:44:50,630 --> 00:44:48,960
and i i'd just like to jump in in terms

1127
00:44:53,190 --> 00:44:50,640
of

1128
00:44:55,910 --> 00:44:53,200
recognizing that the crowd sourcing and

1129
00:44:58,870 --> 00:44:55,920
the engagement even if it's taking

1130
00:45:02,870 --> 00:44:58,880
the after the the original asteroids

1131
00:45:05,190 --> 00:45:02,880
video game that i cut my teeth on

1132
00:45:07,190 --> 00:45:05,200
as a way of providing access to people

1133
00:45:09,430 --> 00:45:07,200
you're right a space mission is going to

1134
00:45:12,950 --> 00:45:09,440
cost a lot of money

1135
00:45:15,349 --> 00:45:12,960
but

1136
00:45:18,230 --> 00:45:15,359
it's an issue that affects everybody on

1137
00:45:21,109 --> 00:45:18,240
the planet and so if we can connect to

1138
00:45:23,910 --> 00:45:21,119

them to show them how this relates

1139
00:45:26,150 --> 00:45:23,920
then it becomes theirs as well and so

1140
00:45:29,109 --> 00:45:26,160
then we don't have to look to some big

1141
00:45:31,589 --> 00:45:29,119
savior coming to

1142
00:45:34,470 --> 00:45:31,599
provide the billion dollar spacecraft

1143
00:45:36,309 --> 00:45:34,480
that's gonna gonna save me but rather i

1144
00:45:38,710 --> 00:45:36,319
see how i'm connected to that and so

1145
00:45:39,990 --> 00:45:38,720
therefore i wanna be a participant in it

1146
00:45:41,510 --> 00:45:40,000
and so

1147
00:45:44,550 --> 00:45:41,520
for me what this

1148
00:45:47,190 --> 00:45:44,560
discussion is really all about is

1149
00:45:48,870 --> 00:45:47,200
we've an incredible science community

1150
00:45:51,349 --> 00:45:48,880
that's been working on this problem for

1151
00:45:52,790 --> 00:45:51,359
a long time but there's an enormous

1152
00:45:55,670 --> 00:45:52,800
number of people

1153
00:45:58,150 --> 00:45:55,680
uh out there and a cognitive wealth that

1154
00:46:00,710 --> 00:45:58,160
we haven't yet tapped into and so this

1155
00:46:03,349 --> 00:46:00,720
is the first way of well not the first

1156
00:46:05,990 --> 00:46:03,359
way but it is a way for us to begin that

1157
00:46:07,829 --> 00:46:06,000
conversation to start to pull people in

1158
00:46:10,790 --> 00:46:07,839
that can help us and accelerate that

1159
00:46:13,430 --> 00:46:10,800
work and and provide the meaning

1160
00:46:14,790 --> 00:46:13,440
and the relevance for them on on why

1161
00:46:17,030 --> 00:46:14,800
chelyabinsk

1162
00:46:19,190 --> 00:46:17,040
uh is an important

1163
00:46:21,670 --> 00:46:19,200

time in their life and you can almost

1164
00:46:23,510 --> 00:46:21,680
see that as the gateway drug to

1165
00:46:24,470 --> 00:46:23,520
potentially saying well now how can i

1166
00:46:26,390 --> 00:46:24,480
help

1167
00:46:27,510 --> 00:46:26,400
and a large part of what we talked about

1168
00:46:29,670 --> 00:46:27,520
yesterday in the citizen science and

1169
00:46:31,829 --> 00:46:29,680
crowdsourcing panel the many of you were

1170
00:46:34,710 --> 00:46:31,839
at but not all of you were at was what

1171
00:46:36,710 --> 00:46:34,720
actually the projectized elements are

1172
00:46:39,030 --> 00:46:36,720
that people can contribute to

1173
00:46:41,349 --> 00:46:39,040
meaningfully in the activity of getting

1174
00:46:43,430 --> 00:46:41,359
more data about each of these potential

1175
00:46:44,870 --> 00:46:43,440
hazardous asteroids as well as helping

1176
00:46:46,069 --> 00:46:44,880
us to for example

1177
00:46:47,589 --> 00:46:46,079
improve

1178
00:46:50,630 --> 00:46:47,599
our ability for machines and our

1179
00:46:52,630 --> 00:46:50,640
algorithms to process the data that tons

1180
00:46:54,069 --> 00:46:52,640
of data these large surveys are taking

1181
00:46:55,910 --> 00:46:54,079
in every day

1182
00:46:57,430 --> 00:46:55,920
as they're as they're trying to discover

1183
00:46:58,870 --> 00:46:57,440
new objects and do tracking and

1184
00:47:00,950 --> 00:46:58,880
characterization of those objects as

1185
00:47:03,510 --> 00:47:00,960
well um we announced a partnership with

1186
00:47:05,829 --> 00:47:03,520
planetary resources yesterday to try to

1187
00:47:07,829 --> 00:47:05,839
develop algorithms based on catalina sky

1188
00:47:10,390 --> 00:47:07,839

survey data to improve the efficiency of

1189
00:47:12,790 --> 00:47:10,400
those algorithms uh using

1190
00:47:15,589 --> 00:47:12,800
the crowd through things like zuniverse

1191
00:47:17,910 --> 00:47:15,599
and top coder challenges to improve upon

1192
00:47:19,190 --> 00:47:17,920
today's state-of-the-art algorithms for

1193
00:47:20,710 --> 00:47:19,200
actually processing through a bunch of

1194
00:47:23,109 --> 00:47:20,720
that data that those large surveys take

1195
00:47:25,589 --> 00:47:23,119
in so there's certainly ways that

1196
00:47:27,670 --> 00:47:25,599
individuals once they're hooked

1197
00:47:30,309 --> 00:47:27,680
may also be able to start kind of

1198
00:47:32,790 --> 00:47:30,319
graduating up the scale of tasks that

1199
00:47:34,309 --> 00:47:32,800
they can help actually be involved in in

1200
00:47:36,950 --> 00:47:34,319
order to help do

1201
00:47:38,390 --> 00:47:36,960
this work in a meaningful way and it may

1202
00:47:41,030 --> 00:47:38,400
not be the three meter telescope in

1203
00:47:42,470 --> 00:47:41,040
their backyard that's gonna cost someone

1204
00:47:44,630 --> 00:47:42,480
a lot of money

1205
00:47:46,069 --> 00:47:44,640
to put up themselves but uh it could be

1206
00:47:47,990 --> 00:47:46,079
follow-up observations that they're

1207
00:47:49,829 --> 00:47:48,000
taking with a smaller uh telescope to

1208
00:47:52,069 --> 00:47:49,839
help with tracking for example or light

1209
00:47:53,589 --> 00:47:52,079
curve analysis which is a sophisticated

1210
00:47:54,950 --> 00:47:53,599
activity but there's a number of

1211
00:47:56,309 --> 00:47:54,960
different ways that we're also trying to

1212
00:47:58,390 --> 00:47:56,319
think about how to

1213
00:48:00,549 --> 00:47:58,400

harness the the time and the expertise

1214
00:48:06,470 --> 00:48:00,559
of folks to meaningfully contribute uh

1215
00:48:11,510 --> 00:48:08,710
is it possible to use something like the

1216
00:48:12,790 --> 00:48:11,520
um the 3d visualization models

1217
00:48:15,510 --> 00:48:12,800
to track

1218
00:48:16,390 --> 00:48:15,520
um asteroids with known telemetries back

1219
00:48:17,829 --> 00:48:16,400
to

1220
00:48:20,470 --> 00:48:17,839
um

1221
00:48:22,150 --> 00:48:20,480
to an origin for example if if a series

1222
00:48:25,349 --> 00:48:22,160
of asteroids that we don't know little

1223
00:48:27,190 --> 00:48:25,359
about was tracked back to a major event

1224
00:48:28,870 --> 00:48:27,200
uh knowing what that event was might be

1225
00:48:30,950 --> 00:48:28,880
able to tell us a lot more about the

1226
00:48:34,549 --> 00:48:30,960
asteroids in our current level of direct

1227
00:48:38,390 --> 00:48:36,309
um that that probably is a better

1228
00:48:39,589 --> 00:48:38,400
question uh for this gentleman right

1229
00:48:45,109 --> 00:48:39,599
here

1230
00:48:50,950 --> 00:48:48,470
yeah uh that's an interesting thought uh

1231
00:48:52,870 --> 00:48:50,960
but right now our knowledge base is not

1232
00:48:54,950 --> 00:48:52,880
good enough to do that we can track

1233
00:48:56,549 --> 00:48:54,960
things for maybe a hundred years okay

1234
00:48:59,829 --> 00:48:56,559
you know with good

1235
00:49:02,630 --> 00:48:59,839
data and good uh detection information

1236
00:49:04,710 --> 00:49:02,640
okay we can kind of run out the

1237
00:49:06,069 --> 00:49:04,720
simulation for maybe 100 years but

1238
00:49:07,430 --> 00:49:06,079

you're talking about multi-body problems

1239
00:49:10,390 --> 00:49:07,440
which always been a big problem in

1240
00:49:13,349 --> 00:49:10,400
physics in general okay and so solving

1241
00:49:15,910 --> 00:49:13,359
multi-body problems you know for small

1242
00:49:18,950 --> 00:49:15,920
bodies interacting with each other and

1243
00:49:22,230 --> 00:49:18,960
with larger bodies like jupiter as well

1244
00:49:25,109 --> 00:49:22,240
as earth and mars uh is a very difficult

1245
00:49:27,990 --> 00:49:25,119
problem so uh and in fact a lot of us

1246
00:49:29,510 --> 00:49:28,000
look at it as you know if we detect it

1247
00:49:31,430 --> 00:49:29,520
we track it and then we can predict for

1248
00:49:33,750 --> 00:49:31,440
100 years it becomes somebody else's

1249
00:49:34,549 --> 00:49:33,760
problem after the next hundred years

1250
00:49:37,030 --> 00:49:34,559
so

1251
00:49:39,349 --> 00:49:37,040
but uh but one uh that certainly is

1252
00:49:41,349 --> 00:49:39,359
worth pursuing and as we get better

1253
00:49:43,109 --> 00:49:41,359
better physical stimulations then we can

1254
00:49:45,349 --> 00:49:43,119
track things for longer periods of time

1255
00:49:47,030 --> 00:49:45,359
but not back to billions of years or

1256
00:49:49,349 --> 00:49:47,040
hundreds of billions or tens of millions

1257
00:49:52,230 --> 00:49:49,359
of years so thanks

1258
00:49:54,390 --> 00:49:52,240
great so um any plans to integrate the

1259
00:49:57,030 --> 00:49:54,400
armed mission scenario into like the

1260
00:49:58,630 --> 00:49:57,040
future module into eyes on the sky so

1261
00:50:00,230 --> 00:49:58,640
that the public can better visualize

1262
00:50:01,829 --> 00:50:00,240
what we're doing and actually at the

1263
00:50:03,430 --> 00:50:01,839

same time you save the mission a little

1264
00:50:05,030 --> 00:50:03,440
bit of money but we could use that as

1265
00:50:07,670 --> 00:50:05,040
our public outreach

1266
00:50:11,109 --> 00:50:07,680
um yeah yes um so i think that's exactly

1267
00:50:12,790 --> 00:50:11,119
what this tool is made for and would be

1268
00:50:14,470 --> 00:50:12,800
it's a great way to

1269
00:50:16,069 --> 00:50:14,480
just show the general public

1270
00:50:19,349 --> 00:50:16,079
how it can work

1271
00:50:20,549 --> 00:50:19,359
be very beneficial yeah i think so

1272
00:50:22,549 --> 00:50:20,559
great

1273
00:50:23,750 --> 00:50:22,559
anything joe

1274
00:50:30,549 --> 00:50:23,760
all right

1275
00:50:30,559 --> 00:50:36,069
our last presenter eric dejong from jpl

1276
00:50:40,309 --> 00:50:38,230
thank you very much and

1277
00:50:43,349 --> 00:50:40,319
basically i'm going to talk about one

1278
00:50:46,710 --> 00:50:43,359
very simple idea and that's the idea of

1279
00:50:49,030 --> 00:50:46,720
automating the creation of videos

1280
00:50:50,230 --> 00:50:49,040
videos for asteroids and in order to do

1281
00:50:52,710 --> 00:50:50,240
that i think

1282
00:50:54,950 --> 00:50:52,720
i'm going to actually run a video okay

1283
00:50:56,630 --> 00:50:54,960
so that'll be on time for my 10 minutes

1284
00:50:59,829 --> 00:50:56,640
uh and

1285
00:51:03,190 --> 00:50:59,839
the idea is very simple people love to

1286
00:51:05,589 --> 00:51:03,200
look at movies okay it's uh we have

1287
00:51:07,829 --> 00:51:05,599
hollywood has done a great job of giving

1288
00:51:09,430 --> 00:51:07,839

us ideas about what asteroid impacts

1289
00:51:11,109 --> 00:51:09,440
would be like

1290
00:51:13,670 --> 00:51:11,119
we'd like to make those things be a

1291
00:51:15,670 --> 00:51:13,680
little more meaningful okay and what i

1292
00:51:18,309 --> 00:51:15,680
listed here are some links that you can

1293
00:51:21,109 --> 00:51:18,319
also follow up on after our meetings

1294
00:51:22,710 --> 00:51:21,119
here and it's the idea of creating both

1295
00:51:26,630 --> 00:51:22,720
movies

1296
00:51:28,710 --> 00:51:26,640
images mosaics maps and models and so

1297
00:51:31,670 --> 00:51:28,720
all of those are things that you can put

1298
00:51:33,670 --> 00:51:31,680
in the hands of people so that

1299
00:51:35,990 --> 00:51:33,680
my idea actually is to replace myself

1300
00:51:37,510 --> 00:51:36,000
with five-year-olds okay and replace all

1301
00:51:38,950 --> 00:51:37,520
my friends with five-year-olds and we'll

1302
00:51:41,190 --> 00:51:38,960
do it in one of two ways we'll be

1303
00:51:42,790 --> 00:51:41,200
successful in giving them the tools so

1304
00:51:45,270 --> 00:51:42,800
they can make better videos than i can

1305
00:51:47,030 --> 00:51:45,280
make or they'll grow and replace me

1306
00:51:50,710 --> 00:51:47,040
anyway so i know i can be successful at

1307
00:51:53,349 --> 00:51:50,720
that so here is the idea in essence okay

1308
00:51:55,829 --> 00:51:53,359
in a block diagram science teams have

1309
00:51:57,670 --> 00:51:55,839
ideas about how you can either trigger

1310
00:52:00,870 --> 00:51:57,680
things by either time

1311
00:52:02,470 --> 00:52:00,880
by an event or by features and there's

1312
00:52:05,270 --> 00:52:02,480
this huge amount of data we're grabbing

1313
00:52:07,750 --> 00:52:05,280

and they're in fact big data allows us

1314
00:52:09,430 --> 00:52:07,760
with artificial intelligence or with

1315
00:52:12,150 --> 00:52:09,440
knowledge based machine language driven

1316
00:52:14,230 --> 00:52:12,160
things to then grab from that pool of

1317
00:52:17,589 --> 00:52:14,240
big data the things we need

1318
00:52:20,230 --> 00:52:17,599
like this okay like an image taught us

1319
00:52:22,790 --> 00:52:20,240
and a light curve and not to just show

1320
00:52:25,109 --> 00:52:22,800
it as a still frame but to automatically

1321
00:52:27,030 --> 00:52:25,119
make the video that would show this and

1322
00:52:30,309 --> 00:52:27,040
i'll show you a video at the end of this

1323
00:52:32,230 --> 00:52:30,319
and the idea is to say look let's let's

1324
00:52:33,270 --> 00:52:32,240
put those tools out there just like

1325
00:52:35,510 --> 00:52:33,280
we're going to

1326
00:52:37,990 --> 00:52:35,520
have a crowd-sourcing approach to

1327
00:52:40,790 --> 00:52:38,000
creating new algorithms let's actually

1328
00:52:41,750 --> 00:52:40,800
create the software that people could

1329
00:52:44,309 --> 00:52:41,760
use

1330
00:52:47,430 --> 00:52:44,319
on their laptop to make videos

1331
00:52:50,230 --> 00:52:47,440
we also want to get an idea of our

1332
00:52:52,630 --> 00:52:50,240
entire mission set for the asteroid

1333
00:52:54,069 --> 00:52:52,640
missions and we have incredible images

1334
00:52:56,309 --> 00:52:54,079
of earth now

1335
00:52:57,910 --> 00:52:56,319
so there's no reason why we can't show

1336
00:53:00,150 --> 00:52:57,920
every spot on earth where people are

1337
00:53:01,670 --> 00:53:00,160
working on asteroids and that includes

1338
00:53:03,670 --> 00:53:01,680

the crowdsourcing stuff but also the

1339
00:53:06,790 --> 00:53:03,680
mission people where are they

1340
00:53:09,589 --> 00:53:06,800
what are they doing and to actually view

1341
00:53:12,069 --> 00:53:09,599
observatories view the operations and

1342
00:53:14,549 --> 00:53:12,079
view the tools as they're being created

1343
00:53:17,670 --> 00:53:14,559
and put out an animation about that

1344
00:53:20,150 --> 00:53:17,680
but what is asteroid impacts all about i

1345
00:53:22,470 --> 00:53:20,160
mean we we know the kinds of killer

1346
00:53:23,910 --> 00:53:22,480
asteroid you know events everybody goes

1347
00:53:26,390 --> 00:53:23,920
back to the kt

1348
00:53:28,710 --> 00:53:26,400
uh kind of event but what about just one

1349
00:53:30,790 --> 00:53:28,720
asteroid hitting another asteroid what

1350
00:53:35,829 --> 00:53:30,800
kind of damage do you do this is

1351
00:53:39,109 --> 00:53:35,839
castelia being hit by a 600 meter

1352
00:53:41,109 --> 00:53:39,119
object okay and what does it look like

1353
00:53:43,349 --> 00:53:41,119
well the red part is like a 7 on the

1354
00:53:44,950 --> 00:53:43,359
richter scale and the tan parts are

1355
00:53:47,349 --> 00:53:44,960
undisturbed

1356
00:53:49,829 --> 00:53:47,359
but how do we get some of this data as

1357
00:53:51,510 --> 00:53:49,839
we plan missions to asteroids

1358
00:53:53,670 --> 00:53:51,520
we can certainly do gold stone

1359
00:53:56,069 --> 00:53:53,680
observations and things like that with

1360
00:53:57,910 --> 00:53:56,079
radar but we can also do stereo

1361
00:54:00,630 --> 00:53:57,920
observations if we have

1362
00:54:03,270 --> 00:54:00,640
actually cameras on the

1363
00:54:07,270 --> 00:54:03,280

systems that we build then this is just

1364
00:54:09,589 --> 00:54:07,280
an example of a 3d model of a 60

1365
00:54:11,670 --> 00:54:09,599
kilometer crater made from 300

1366
00:54:14,470 --> 00:54:11,680
kilometers above

1367
00:54:17,510 --> 00:54:14,480
at 25 centimeters per pixel

1368
00:54:20,069 --> 00:54:17,520
if we also want to show exactly what

1369
00:54:22,069 --> 00:54:20,079
the whole asteroid mission is about

1370
00:54:23,750 --> 00:54:22,079
we can use cad cam models but we can

1371
00:54:26,710 --> 00:54:23,760
also use pictures to create

1372
00:54:29,750 --> 00:54:26,720
photorealistic images we don't have a

1373
00:54:31,750 --> 00:54:29,760
camera watching the curiosity rover yet

1374
00:54:32,870 --> 00:54:31,760
we're all familiar with watching it on

1375
00:54:35,270 --> 00:54:32,880
tv

1376
00:54:37,910 --> 00:54:35,280
and the reason is we can build a model

1377
00:54:40,230 --> 00:54:37,920
of it that we can then create a computer

1378
00:54:42,870 --> 00:54:40,240
graphic model and then the terrain we

1379
00:54:44,150 --> 00:54:42,880
have beneath here is real terrain

1380
00:54:45,030 --> 00:54:44,160
and

1381
00:54:46,789 --> 00:54:45,040
so

1382
00:54:49,510 --> 00:54:46,799
here's the idea

1383
00:54:50,710 --> 00:54:49,520
if we observe things collect this pool

1384
00:54:52,470 --> 00:54:50,720
of data

1385
00:54:55,030 --> 00:54:52,480
we can then visualize them with these

1386
00:54:58,549 --> 00:54:55,040
automatic techniques and then we can

1387
00:55:01,430 --> 00:54:58,559
embed the videos and use the models

1388
00:55:04,069 --> 00:55:01,440

and the images and the maps and the

1389
00:55:06,470 --> 00:55:04,079
mosaics to populate things like eyes in

1390
00:55:07,670 --> 00:55:06,480
the solar system and also to populate

1391
00:55:11,109 --> 00:55:07,680
things like commercial tools like

1392
00:55:13,670 --> 00:55:11,119
skyscan and lots of others that people

1393
00:55:16,549 --> 00:55:13,680
currently use in planetarium domes so

1394
00:55:18,789 --> 00:55:16,559
that when they're at the right place you

1395
00:55:21,670 --> 00:55:18,799
know and in the moment they can

1396
00:55:23,670 --> 00:55:21,680
visualize things right there on the spot

1397
00:55:26,710 --> 00:55:23,680
and there's no reason not to do this

1398
00:55:28,950 --> 00:55:26,720
it's just a matter of wanting to do it

1399
00:55:31,990 --> 00:55:28,960
so let's look at some of the images and

1400
00:55:33,990 --> 00:55:32,000
videos this is a real time video

1401
00:55:35,670 --> 00:55:34,000
this is how fast this thing moves it's

1402
00:55:38,230 --> 00:55:35,680
75 tons

1403
00:55:40,950 --> 00:55:38,240
of a telescope that is on haleakala

1404
00:55:43,510 --> 00:55:40,960
crater and this is used to track very

1405
00:55:46,710 --> 00:55:43,520
fast moving averages by the air force

1406
00:55:49,589 --> 00:55:46,720
just for comparison this is not

1407
00:55:52,630 --> 00:55:49,599
an image of an antenna at goldstone okay

1408
00:55:54,630 --> 00:55:52,640
this is a computer graphic of an antenna

1409
00:55:56,150 --> 00:55:54,640
at goldstone and so when i say you know

1410
00:55:57,910 --> 00:55:56,160
this is something we can do i don't mean

1411
00:56:00,630 --> 00:55:57,920
something we do tomorrow and there's

1412
00:56:02,150 --> 00:56:00,640
something we can do now today and so

1413
00:56:04,309 --> 00:56:02,160

it's very difficult to tell the

1414
00:56:06,789 --> 00:56:04,319
difference between whether i have a

1415
00:56:08,390 --> 00:56:06,799
video camera at 4k or whether i have

1416
00:56:10,549 --> 00:56:08,400
images at 4k

1417
00:56:14,309 --> 00:56:10,559
these are some radar observations taken

1418
00:56:16,549 --> 00:56:14,319
by that antenna at goldstone okay and

1419
00:56:18,230 --> 00:56:16,559
i'm not saying i want to blur reality

1420
00:56:20,470 --> 00:56:18,240
i'm saying i want to take the computer

1421
00:56:23,990 --> 00:56:20,480
graphics when we do computer graphics to

1422
00:56:25,670 --> 00:56:24,000
make them as real as the photo images

1423
00:56:26,870 --> 00:56:25,680
that we take

1424
00:56:30,150 --> 00:56:26,880
here is actually the data that's

1425
00:56:32,309 --> 00:56:30,160
returned and this is from castelia it's

1426
00:56:33,990 --> 00:56:32,319
just range and doppler cells just these

1427
00:56:35,030 --> 00:56:34,000
little blobs are what you're really

1428
00:56:37,589 --> 00:56:35,040
returning

1429
00:56:40,950 --> 00:56:37,599
but from those you can say okay i make a

1430
00:56:43,829 --> 00:56:40,960
simulation and i can try to say what

1431
00:56:46,069 --> 00:56:43,839
kind of shape model would it take to

1432
00:56:47,270 --> 00:56:46,079
return this range and doppler data and

1433
00:56:49,270 --> 00:56:47,280
the first thing i'm going to do is draw

1434
00:56:51,190 --> 00:56:49,280
a little convex hull little white thing

1435
00:56:53,670 --> 00:56:51,200
but then i can actually make that model

1436
00:56:54,950 --> 00:56:53,680
the unique model that fits those ranging

1437
00:56:55,910 --> 00:56:54,960
doppler cells

1438
00:56:58,390 --> 00:56:55,920

and get

1439
00:57:00,230 --> 00:56:58,400
30 meter kind of resolution from

1440
00:57:02,549 --> 00:57:00,240
radar observations

1441
00:57:04,390 --> 00:57:02,559
and you may think is well is that model

1442
00:57:05,829 --> 00:57:04,400
true and actually when we made these

1443
00:57:07,910 --> 00:57:05,839
bubbles it took us years to make the

1444
00:57:11,270 --> 00:57:07,920
first couple and now we can do them in

1445
00:57:12,549 --> 00:57:11,280
real time so here's a light curve that

1446
00:57:13,990 --> 00:57:12,559
we produced

1447
00:57:16,470 --> 00:57:14,000
before

1448
00:57:18,230 --> 00:57:16,480
a set of observations were

1449
00:57:20,390 --> 00:57:18,240
before an epic of observations or what

1450
00:57:22,309 --> 00:57:20,400
happened on the ground so we predicted

1451
00:57:23,750 --> 00:57:22,319
it from the radar observations

1452
00:57:25,750 --> 00:57:23,760
and then

1453
00:57:26,549 --> 00:57:25,760
as the observations were being made the

1454
00:57:29,349 --> 00:57:26,559
red

1455
00:57:30,789 --> 00:57:29,359
are optical observations down on the

1456
00:57:32,549 --> 00:57:30,799
ground with other observatories we

1457
00:57:34,710 --> 00:57:32,559
collect them and we're not perfect see

1458
00:57:35,910 --> 00:57:34,720
there's one that missed right there okay

1459
00:57:38,150 --> 00:57:35,920
but

1460
00:57:41,270 --> 00:57:38,160
it shows how well

1461
00:57:43,349 --> 00:57:41,280
this 30 meter model matches the real

1462
00:57:45,030 --> 00:57:43,359
observations so before that i thought

1463
00:57:47,109 --> 00:57:45,040

it's a great thing to use for

1464
00:57:49,270 --> 00:57:47,119
visualizations but i didn't have a great

1465
00:57:50,870 --> 00:57:49,280
belief in it but after we did a few

1466
00:57:53,750 --> 00:57:50,880
examples like this

1467
00:57:56,390 --> 00:57:53,760
i think it's a very very good predictor

1468
00:57:58,630 --> 00:57:56,400
of what you're likely to see

1469
00:58:01,589 --> 00:57:58,640
and the shape model for test has been

1470
00:58:03,670 --> 00:58:01,599
updated again and each time that we have

1471
00:58:05,910 --> 00:58:03,680
it fly by the earth we take the set of

1472
00:58:08,390 --> 00:58:05,920
radar observations and and build the

1473
00:58:11,589 --> 00:58:08,400
model and improve it each time

1474
00:58:12,710 --> 00:58:11,599
and those models are available just like

1475
00:58:16,069 --> 00:58:12,720
the

1476
00:58:18,630 --> 00:58:16,079
and

1477
00:58:21,030 --> 00:58:18,640
another question yesterday was

1478
00:58:23,589 --> 00:58:21,040
gee why not have the minor planetary

1479
00:58:26,069 --> 00:58:23,599
center add images well i'd like to have

1480
00:58:28,630 --> 00:58:26,079
them add images and models

1481
00:58:31,750 --> 00:58:28,640
so that you have one-stop shopping for

1482
00:58:34,390 --> 00:58:31,760
models images light curves videos you

1483
00:58:36,549 --> 00:58:34,400
know you have it all in one place

1484
00:58:38,470 --> 00:58:36,559
and simulation so this is a simulation

1485
00:58:40,870 --> 00:58:38,480
by eric ashford again

1486
00:58:42,950 --> 00:58:40,880
not only showing the impact but showing

1487
00:58:45,270 --> 00:58:42,960
then each of

1488
00:58:48,470 --> 00:58:45,280

other pieces of the asteroid are thrown

1489
00:58:49,990 --> 00:58:48,480
off to become impactors themselves so we

1490
00:58:52,390 --> 00:58:50,000
kind of live in a cosmic shooting

1491
00:58:53,750 --> 00:58:52,400
gallery okay with all these asteroids

1492
00:58:56,230 --> 00:58:53,760
and all these impacts and you can even

1493
00:58:58,710 --> 00:58:56,240
see that castillo's formed most likely

1494
00:59:00,950 --> 00:58:58,720
by an impact itself by two other objects

1495
00:59:02,309 --> 00:59:00,960
together and there's a lot of examples

1496
00:59:05,030 --> 00:59:02,319
of that and there's a lot of examples

1497
00:59:07,109 --> 00:59:05,040
even on venus and on the moon and on

1498
00:59:09,430 --> 00:59:07,119
mercury where you can see that some of

1499
00:59:11,430 --> 00:59:09,440
the impacts were dual impacts

1500
00:59:13,190 --> 00:59:11,440
and so

1501
00:59:14,309 --> 00:59:13,200
people can

1502
00:59:15,750 --> 00:59:14,319
right now

1503
00:59:19,750 --> 00:59:15,760
today

1504
00:59:22,390 --> 00:59:19,760
with the tools we have make flyovers of

1505
00:59:24,470 --> 00:59:22,400
asteroids or flyovers of mars this is

1506
00:59:27,190 --> 00:59:24,480
just one example of

1507
00:59:29,109 --> 00:59:27,200
a quarter of a million images taken by

1508
00:59:31,510 --> 00:59:29,119
the mars reconnaissance orbiter

1509
00:59:33,349 --> 00:59:31,520
high-rise camera this is just from one

1510
00:59:38,390 --> 00:59:33,359
single image

1511
00:59:41,829 --> 00:59:38,400
is 20 000 pixels by 60 000 pixels long

1512
00:59:44,069 --> 00:59:41,839
and those kinds of camera systems

1513
00:59:45,349 --> 00:59:44,079

have been available for a decade those

1514
00:59:47,910 --> 00:59:45,359
are the kind of camera systems we'll

1515
00:59:49,030 --> 00:59:47,920
have on our mission so we will be able

1516
00:59:52,549 --> 00:59:49,040
to see

1517
00:59:54,390 --> 00:59:52,559
asteroids at these kinds of resolutions

1518
00:59:57,109 --> 00:59:54,400
both now and in the future

1519
00:59:59,589 --> 00:59:57,119
and i'm not ending with mars i'm

1520
01:00:02,309 --> 00:59:59,599
actually ending with juno

1521
01:00:03,990 --> 01:00:02,319
here is this is all simulated this is

1522
01:00:06,390 --> 01:00:04,000
simulated launch

1523
01:00:08,230 --> 01:00:06,400
simulated deployment okay

1524
01:00:09,190 --> 01:00:08,240
and the reason i wanted to end with juno

1525
01:00:11,270 --> 01:00:09,200
was

1526
01:00:15,510 --> 01:00:11,280
at our previous workshop

1527
01:00:17,750 --> 01:00:15,520
it was a week before a near-earth object

1528
01:00:20,230 --> 01:00:17,760
was going to fly by the earth a very

1529
01:00:23,030 --> 01:00:20,240
predictable one a very small one and you

1530
01:00:24,950 --> 01:00:23,040
know a few tens of meters across that

1531
01:00:28,549 --> 01:00:24,960
would be the juno spacecraft it was

1532
01:00:29,510 --> 01:00:28,559
flying by at 35 to 39 kilometers per

1533
01:00:32,069 --> 01:00:29,520
second

1534
01:00:33,990 --> 01:00:32,079
the speed of a very fast near-earth

1535
01:00:35,990 --> 01:00:34,000
object and so

1536
01:00:37,430 --> 01:00:36,000
if you want to see more about that

1537
01:00:39,510 --> 01:00:37,440
encounter

1538
01:00:41,430 --> 01:00:39,520

and it we did use it actually as an

1539
01:00:43,190 --> 01:00:41,440
example where people could observe it

1540
01:00:45,109 --> 01:00:43,200
like they would observe an asteroid

1541
01:00:47,589 --> 01:00:45,119
there'll be more at the agu on december

1542
01:00:48,630 --> 01:00:47,599
10th so i thank you for your interest

1543
01:00:50,309 --> 01:00:48,640
and thank you for the chance to come

1544
01:00:52,630 --> 01:00:50,319
here and talk about this and again this

1545
01:00:58,870 --> 01:00:52,640
is the kind of thing we can do today

1546
01:01:05,670 --> 01:01:00,390
wow

1547
01:01:08,950 --> 01:01:06,950
that's all

1548
01:01:11,190 --> 01:01:08,960
eric i have a super geeky question so

1549
01:01:14,470 --> 01:01:11,200
this process that identifies the 3d

1550
01:01:16,549 --> 01:01:14,480
model from the radar data and stuff

1551
01:01:18,230 --> 01:01:16,559
does it typically converge to a single

1552
01:01:20,549 --> 01:01:18,240
solution or are there multiple good

1553
01:01:23,670 --> 01:01:20,559
candidates for the for the shape

1554
01:01:26,150 --> 01:01:23,680
well um that's a very good question and

1555
01:01:28,950 --> 01:01:26,160
if you have enough samples enough

1556
01:01:31,990 --> 01:01:28,960
samples in time of range of doppler it

1557
01:01:33,829 --> 01:01:32,000
will converge to a single solution

1558
01:01:35,589 --> 01:01:33,839
but that means you have to have been

1559
01:01:38,549 --> 01:01:35,599
able to observe it long enough and

1560
01:01:41,030 --> 01:01:38,559
typically a few tens or hundreds of

1561
01:01:43,190 --> 01:01:41,040
samples are great so if you see tens or

1562
01:01:44,230 --> 01:01:43,200
hundredths in time of range and doppler

1563
01:01:46,549 --> 01:01:44,240

then you can probably get a unique

1564
01:01:48,549 --> 01:01:46,559
solution if you have less than that then

1565
01:01:50,549 --> 01:01:48,559
you'll have multiple solutions and

1566
01:01:53,109 --> 01:01:50,559
you'll but then you create multiple

1567
01:01:55,029 --> 01:01:53,119
models and then later if you get another

1568
01:01:58,630 --> 01:01:55,039
observation you can correct it

1569
01:02:02,549 --> 01:02:00,230
and scott hudson by the way was the

1570
01:02:04,549 --> 01:02:02,559
person who first was able to do this at

1571
01:02:07,750 --> 01:02:04,559
university of washington and he had this

1572
01:02:09,990 --> 01:02:07,760
kind of lab where he tested his

1573
01:02:13,029 --> 01:02:10,000
capability by using a different instead

1574
01:02:15,829 --> 01:02:13,039
of range and doppler from a radio

1575
01:02:17,270 --> 01:02:15,839
frequency he did it with lidar okay and

1576
01:02:19,510 --> 01:02:17,280
laser and so that's why he was able to

1577
01:02:21,510 --> 01:02:19,520
perfect this technique

1578
01:02:23,430 --> 01:02:21,520
eric can you

1579
01:02:24,950 --> 01:02:23,440
based on just uh photometric light

1580
01:02:25,990 --> 01:02:24,960
curves and maybe

1581
01:02:28,549 --> 01:02:26,000
um

1582
01:02:30,470 --> 01:02:28,559
occultation chords after

1583
01:02:31,589 --> 01:02:30,480
large asteroids go in front of the start

1584
01:02:34,549 --> 01:02:31,599
can you

1585
01:02:36,950 --> 01:02:34,559
even get a close model

1586
01:02:39,270 --> 01:02:36,960
based on those that type of limited

1587
01:02:42,549 --> 01:02:39,280
data uh yeah that's a very good question

1588
01:02:44,630 --> 01:02:42,559

as well yes you can uh it won't be the

1589
01:02:46,390 --> 01:02:44,640
same kind of resolution as you get you

1590
01:02:48,710 --> 01:02:46,400
know you saw it here for chittas but

1591
01:02:50,870 --> 01:02:48,720
nonetheless you can you can get kind of

1592
01:02:53,190 --> 01:02:50,880
a generic shape of whether it's kind of

1593
01:02:55,750 --> 01:02:53,200
spherical or two spheres or you know

1594
01:02:58,470 --> 01:02:55,760
what kind of lobes so indeed you can and

1595
01:02:59,990 --> 01:02:58,480
it's certainly a first good fit and in

1596
01:03:02,150 --> 01:03:00,000
the very early animation we just did a

1597
01:03:03,829 --> 01:03:02,160
convex hull on the thing you know and

1598
01:03:06,390 --> 01:03:03,839
you can do those kind of things starting

1599
01:03:08,309 --> 01:03:06,400
and then depending on which

1600
01:03:14,630 --> 01:03:08,319
number of observations you have and its

1601
01:03:18,309 --> 01:03:16,549
i think carl was suggesting that's why

1602
01:03:20,630 --> 01:03:18,319
it's also good for amateurs to give us

1603
01:03:21,910 --> 01:03:20,640
more phase information uh which again

1604
01:03:24,390 --> 01:03:21,920
would help with those models so that's

1605
01:03:26,950 --> 01:03:24,400
again a place where citizen science

1606
01:03:29,109 --> 01:03:26,960
could help us in fact build those models

1607
01:03:30,470 --> 01:03:29,119
yeah

1608
01:03:45,829 --> 01:03:30,480
i

1609
01:03:47,990 --> 01:03:45,839
uh you know because

1610
01:03:49,910 --> 01:03:48,000
the flux of data coming back from

1611
01:03:51,670 --> 01:03:49,920
other folks but unmanned spaceflight.com

1612
01:03:54,589 --> 01:03:51,680
is an interesting resource but it's not

1613
01:03:56,950 --> 01:03:54,599

calibrated right so well iman's

1614
01:03:59,109 --> 01:03:56,960
facebook.com is

1615
01:04:00,870 --> 01:03:59,119
is a great resource and they have a lot

1616
01:04:03,190 --> 01:04:00,880
of enthusiastic people working on it

1617
01:04:05,750 --> 01:04:03,200
okay and they some of the people there

1618
01:04:08,390 --> 01:04:05,760
use the same tools in fact literally the

1619
01:04:10,630 --> 01:04:08,400
same tools as nasa provides and in fact

1620
01:04:12,870 --> 01:04:10,640
you check the credits and some of the

1621
01:04:14,710 --> 01:04:12,880
people that are involved on uh very

1622
01:04:15,589 --> 01:04:14,720
often the same people that are on the

1623
01:04:18,390 --> 01:04:15,599
mission

1624
01:04:20,549 --> 01:04:18,400
may be part of unmanned spaceflight.com

1625
01:04:22,230 --> 01:04:20,559
so and and we hire some of them as well

1626
01:04:24,549 --> 01:04:22,240
so it's a it's a great resource in many

1627
01:04:26,390 --> 01:04:24,559
ways and again it's another indication

1628
01:04:29,270 --> 01:04:26,400
where if we

1629
01:04:31,190 --> 01:04:29,280
make the source code

1630
01:04:33,589 --> 01:04:31,200
available with the tools there are

1631
01:04:35,670 --> 01:04:33,599
amateurs who are willing to learn go

1632
01:04:38,789 --> 01:04:35,680
through the steep learning curve of

1633
01:04:41,589 --> 01:04:38,799
adapting those tools and using them and

1634
01:04:43,430 --> 01:04:41,599
and they are very professional acting

1635
01:04:44,150 --> 01:04:43,440
imagers so yes

1636
01:04:46,309 --> 01:04:44,160
and

1637
01:04:48,230 --> 01:04:46,319
in the case of juno we encourage them to

1638
01:04:49,910 --> 01:04:48,240

actually produce their own images during

1639
01:04:52,390 --> 01:04:49,920
the earth encounter and we have a

1640
01:04:54,789 --> 01:04:52,400
gallery where we feature you know

1641
01:04:59,750 --> 01:04:54,799
everybody's images not just the ones

1642
01:05:02,390 --> 01:05:00,950
i think

1643
01:05:04,470 --> 01:05:02,400
related to that online there's a

1644
01:05:06,390 --> 01:05:04,480
question on um

1645
01:05:08,470 --> 01:05:06,400
where can people find

1646
01:05:10,150 --> 01:05:08,480
access to the to the models in the data

1647
01:05:13,430 --> 01:05:10,160
to be able to participate in some of

1648
01:05:15,349 --> 01:05:13,440
that yeah actually my second slide which

1649
01:05:18,630 --> 01:05:15,359
i think the slides are available you

1650
01:05:21,190 --> 01:05:18,640
know online my second slide actually has

1651
01:05:22,470 --> 01:05:21,200
not a full set of links okay i knew that

1652
01:05:23,910 --> 01:05:22,480
dave was going to talk before me so i

1653
01:05:26,069 --> 01:05:23,920
didn't include the eyes on the solar

1654
01:05:28,710 --> 01:05:26,079
system because i knew he had that link

1655
01:05:31,270 --> 01:05:28,720
but it includes some additional ones

1656
01:05:33,910 --> 01:05:31,280
including ones where on a nasa home page

1657
01:05:35,990 --> 01:05:33,920
you have access to 3d models

1658
01:05:37,750 --> 01:05:36,000
many of which are the ones that were

1659
01:05:39,589 --> 01:05:37,760
used in

1660
01:05:41,029 --> 01:05:39,599
the eyes in the solar system but also

1661
01:05:42,549 --> 01:05:41,039
additional models like models of

1662
01:05:44,470 --> 01:05:42,559
spacecraft that

1663
01:05:46,470 --> 01:05:44,480

that you can actually download yourself

1664
01:05:49,349 --> 01:05:46,480
and use with

1665
01:05:50,470 --> 01:05:49,359
both commercial tools but also with

1666
01:05:53,029 --> 01:05:50,480
free

1667
01:05:54,710 --> 01:05:53,039
tools as well that are available so yes

1668
01:05:56,870 --> 01:05:54,720
so take a look at the second slide and

1669
01:05:57,990 --> 01:05:56,880
the slide should be available in about a

1670
01:06:05,750 --> 01:05:58,000
week

1671
01:06:10,470 --> 01:06:08,309
let me it looks like we're uh done with

1672
01:06:12,309 --> 01:06:10,480
questions i just

1673
01:06:13,910 --> 01:06:12,319
given our conversation yesterday about

1674
01:06:17,029 --> 01:06:13,920
crowdsourcing and

1675
01:06:20,150 --> 01:06:17,039
and and phase work and light curves

1676
01:06:24,069 --> 01:06:20,160
this adds a whole nother layer into

1677
01:06:26,150 --> 01:06:24,079
the power of visualization and so

1678
01:06:28,230 --> 01:06:26,160
one of the things that we've recognized

1679
01:06:30,069 --> 01:06:28,240
as we think to engage the amateur

1680
01:06:32,230 --> 01:06:30,079
community in light curve work it's

1681
01:06:34,470 --> 01:06:32,240
really difficult

1682
01:06:35,750 --> 01:06:34,480
but i think what we've seen these last

1683
01:06:39,430 --> 01:06:35,760
two presentations the power

1684
01:06:42,470 --> 01:06:39,440
visualization opens up doors and access

1685
01:06:44,470 --> 01:06:42,480
for people that then can trigger

1686
01:06:46,470 --> 01:06:44,480
some of the deeper work and so to see

1687
01:06:48,630 --> 01:06:46,480
now how things are starting to pull

1688
01:06:51,510 --> 01:06:48,640

together and the potential overlap here

1689
01:06:53,270 --> 01:06:51,520
is really really exciting

1690
01:06:55,829 --> 01:06:53,280
i meant make one last comment and that

1691
01:06:57,829 --> 01:06:55,839
is the juno flyby isn't certainly not

1692
01:07:00,870 --> 01:06:57,839
the only spacecraft flyby that will have

1693
01:07:02,069 --> 01:07:00,880
yeah okay and perhaps we may want to

1694
01:07:05,109 --> 01:07:02,079
consider

1695
01:07:06,470 --> 01:07:05,119
that these kind of flyby missions are

1696
01:07:08,309 --> 01:07:06,480
practice runs

1697
01:07:11,270 --> 01:07:08,319
for near-earth

1698
01:07:12,710 --> 01:07:11,280
object observations that can engage the

1699
01:07:14,630 --> 01:07:12,720
public as well as professional

1700
01:07:15,829 --> 01:07:14,640
observatories in fact

1701
01:07:18,150 --> 01:07:15,839
several people from the conference i

1702
01:07:20,390 --> 01:07:18,160
don't want to do justice to anybody but

1703
01:07:23,029 --> 01:07:20,400
or injustice to anyone but several

1704
01:07:25,670 --> 01:07:23,039
people ended up observing juno that were

1705
01:07:29,349 --> 01:07:25,680
at this conference as a result of

1706
01:07:31,430 --> 01:07:29,359
our discussions so fantastic

1707
01:07:36,870 --> 01:07:31,440
that's great thanks again yeah thank you

1708
01:07:43,270 --> 01:07:41,029
all right let's take a short break

1709
01:07:45,029 --> 01:07:43,280
and come back and then uh hope to have

1710
01:07:46,710 --> 01:07:45,039
some good discussion based on what we've

1711
01:07:49,910 --> 01:07:46,720
seen and then other ideas that you might

1712
01:07:52,390 --> 01:07:49,920
have on on moving forward uh with this

1713
01:07:54,150 --> 01:07:52,400

uh next generation of engagement

1714
01:07:55,510 --> 01:07:54,160
so about 10 minute break we'll be back