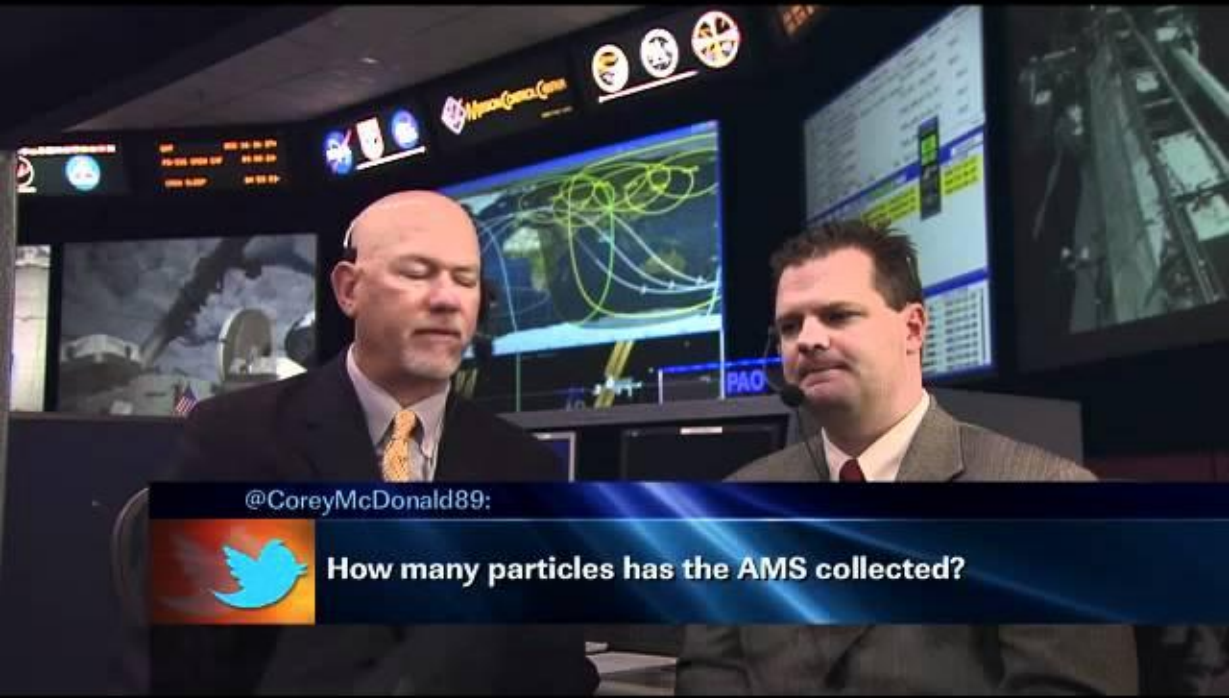
PAO
@CoreyMcDonald89:
How many particles has the AMS collected?

1
00:00:05,430 --> 00:00:03,750
trent martin the johnson space center's

2
00:00:07,590 --> 00:00:05,440
project manager for the alpha magnetic

3
00:00:09,589 --> 00:00:07,600
spectrometer is here with us in mission

4
00:00:12,230 --> 00:00:09,599
control today for an interview

5
00:00:13,830 --> 00:00:12,240
and so uh welcome in trent

6
00:00:15,589 --> 00:00:13,840
thanks i appreciate it

7
00:00:17,510 --> 00:00:15,599
great to have you here today and to talk

8
00:00:19,429 --> 00:00:17,520
about ams as we call it on the

9
00:00:20,790 --> 00:00:19,439
international space station

10
00:00:22,710 --> 00:00:20,800
can you start off telling us a little

11
00:00:24,630 --> 00:00:22,720
bit about what an alpha magnetic

12
00:00:26,710 --> 00:00:24,640
spectrometer does

13
00:00:29,589 --> 00:00:26,720

sure the alpha magnetic spectrometer is

14
00:00:31,589 --> 00:00:29,599
a high energy physics experiment

15
00:00:33,350 --> 00:00:31,599
that was built by a collaboration of 60

16
00:00:35,910 --> 00:00:33,360
different institutes from 16 different

17
00:00:37,990 --> 00:00:35,920
countries and led by a nobel laureate

18
00:00:39,190 --> 00:00:38,000
from mit

19
00:00:41,430 --> 00:00:39,200
that

20
00:00:44,470 --> 00:00:41,440
combines a system of state-of-the-art

21
00:00:46,549 --> 00:00:44,480
high-energy particle physics detectors

22
00:00:48,869 --> 00:00:46,559
uh to sift through the particles that

23
00:00:51,189 --> 00:00:48,879
are constantly bombarding the earth

24
00:00:52,709 --> 00:00:51,199
we do it in space simply because most of

25
00:00:54,470 --> 00:00:52,719
these charged particles would not make

26
00:00:56,549 --> 00:00:54,480
it to the ground

27
00:00:58,470 --> 00:00:56,559
so the space station provides a perfect

28
00:01:00,150 --> 00:00:58,480
test bed for us to

29
00:01:02,229 --> 00:01:00,160
to utilize and

30
00:01:04,789 --> 00:01:02,239
actually measure these particles as they

31
00:01:08,149 --> 00:01:04,799
come through the detector the detector

32
00:01:11,750 --> 00:01:10,230
what type of particles we have so you

33
00:01:14,710 --> 00:01:11,760
can you can tell the difference between

34
00:01:15,590 --> 00:01:14,720
a helium atom and or an anti-helium atom

35
00:01:17,030 --> 00:01:15,600
um

36
00:01:19,350 --> 00:01:17,040
the the main science that we're looking

37
00:01:22,390 --> 00:01:19,360
for is anti-matter science dark matter

38
00:01:24,630 --> 00:01:22,400

science uh and and other cosmic ray

39
00:01:26,550 --> 00:01:24,640
propagation in the universe

40
00:01:29,590 --> 00:01:26,560
and i got to ask you why should i care

41
00:01:31,190 --> 00:01:29,600
about dark matter and antimatter and all

42
00:01:32,390 --> 00:01:31,200
those cosmic rays

43
00:01:33,749 --> 00:01:32,400
well ams

44
00:01:35,510 --> 00:01:33,759
is a detector that's essentially

45
00:01:36,789 --> 00:01:35,520
designed to probe the foundations of the

46
00:01:37,590 --> 00:01:36,799
universe

47
00:01:40,069 --> 00:01:37,600
so

48
00:01:42,230 --> 00:01:40,079
the data that we'll gather from ams we

49
00:01:44,149 --> 00:01:42,240
will we will utilize for years to come

50
00:01:46,230 --> 00:01:44,159
to help to identify

51
00:01:48,710 --> 00:01:46,240
what was the universe like at the

52
00:01:52,149 --> 00:01:48,720
beginning what is it like now and where

53
00:01:54,710 --> 00:01:52,159
are we going um how was it made up is

54
00:01:57,190 --> 00:01:54,720
half the universe made out of antimatter

55
00:01:58,870 --> 00:01:57,200
what is dark matter what is that 90 of

56
00:02:01,350 --> 00:01:58,880
the universe that we now know exists but

57
00:02:03,429 --> 00:02:01,360
we don't know what it is

58
00:02:05,749 --> 00:02:03,439
okay well tell us a little bit about

59
00:02:08,150 --> 00:02:05,759
yourself uh how did you get to this

60
00:02:10,150 --> 00:02:08,160
point in your career where are you from

61
00:02:12,150 --> 00:02:10,160
um i'm from

62
00:02:13,190 --> 00:02:12,160
all over the midwest and texas

63
00:02:20,949 --> 00:02:13,200

i

64
00:02:22,470 --> 00:02:20,959
houston clear lake

65
00:02:23,750 --> 00:02:22,480
so why would i be working with a bunch

66
00:02:25,750 --> 00:02:23,760
of physicists

67
00:02:27,589 --> 00:02:25,760
well mainly because nasa has the

68
00:02:29,990 --> 00:02:27,599
responsibility to do the the project

69
00:02:32,229 --> 00:02:30,000
management and integration of this uh of

70
00:02:34,630 --> 00:02:32,239
this high energy physics experiment

71
00:02:37,030 --> 00:02:34,640
so as an engineer i have to work with

72
00:02:38,869 --> 00:02:37,040
600 physicists engineers and technicians

73
00:02:40,869 --> 00:02:38,879
across the globe

74
00:02:41,990 --> 00:02:40,879
most of them being funded by other

75
00:02:43,430 --> 00:02:42,000
agencies

76
00:02:46,070 --> 00:02:43,440
to work together to build this

77
00:02:48,390 --> 00:02:46,080
experiment to operate this experiment

78
00:02:50,070 --> 00:02:48,400
it's a very interesting

79
00:02:52,470 --> 00:02:50,080
process and it's been a learning

80
00:02:53,589 --> 00:02:52,480
experience for me

81
00:02:55,190 --> 00:02:53,599
tell us a little bit about what it was

82
00:02:57,430 --> 00:02:55,200
like growing up as a kid when you grew

83
00:02:59,270 --> 00:02:57,440
up and and did you ever think you might

84
00:03:02,070 --> 00:02:59,280
be here doing this

85
00:03:04,390 --> 00:03:02,080
no absolutely not

86
00:03:05,350 --> 00:03:04,400
i grew up in small towns

87
00:03:07,990 --> 00:03:05,360
um

88
00:03:08,949 --> 00:03:08,000

never thought i would ever say that i've

89
00:03:10,790 --> 00:03:08,959
been to

90
00:03:11,589 --> 00:03:10,800
as many foreign countries as i've been

91
00:03:13,589 --> 00:03:11,599
to

92
00:03:15,990 --> 00:03:13,599
um

93
00:03:18,309 --> 00:03:16,000
no there was no way that as a kid i ever

94
00:03:20,550 --> 00:03:18,319
said i would be doing this but nasa has

95
00:03:21,670 --> 00:03:20,560
afforded that opportunity

96
00:03:23,509 --> 00:03:21,680
because of the international

97
00:03:25,030 --> 00:03:23,519
collaborations that we have

98
00:03:26,229 --> 00:03:25,040
in particular with this international

99
00:03:28,869 --> 00:03:26,239
space station

100
00:03:30,710 --> 00:03:28,879
ams is interesting in that we have as

101
00:03:31,750 --> 00:03:30,720
many countries as the space station has

102
00:03:35,350 --> 00:03:31,760
countries

103
00:03:37,990 --> 00:03:35,360
they're typically not the space

104
00:03:39,830 --> 00:03:38,000
institutions so they're not

105
00:03:42,229 --> 00:03:39,840
they're not jackson those types of

106
00:03:43,509 --> 00:03:42,239
agencies instead they're the physics

107
00:03:44,869 --> 00:03:43,519
institutions from those different

108
00:03:46,949 --> 00:03:44,879
countries

109
00:03:47,910 --> 00:03:46,959
so certainly i've met a lot of people

110
00:03:50,149 --> 00:03:47,920
um

111
00:03:51,430 --> 00:03:50,159
very interesting people that

112
00:03:52,550 --> 00:03:51,440
that are learning things about this

113
00:03:53,589 --> 00:03:52,560

universe

114
00:03:55,030 --> 00:03:53,599
that

115
00:03:56,869 --> 00:03:55,040
there's no way i ever thought i would be

116
00:03:58,470 --> 00:03:56,879
part of that

117
00:04:02,229 --> 00:03:58,480
okay

118
00:04:03,670 --> 00:04:02,239
tell us a little bit about why ams

119
00:04:05,429 --> 00:04:03,680
can take advantage of the space station

120
00:04:07,110 --> 00:04:05,439
what's important about the space station

121
00:04:08,309 --> 00:04:07,120
for the being able to conduct this

122
00:04:09,670 --> 00:04:08,319
experiment

123
00:04:11,110 --> 00:04:09,680
so the biggest advantage that we have

124
00:04:13,350 --> 00:04:11,120
with the international space station is

125
00:04:15,910 --> 00:04:13,360
that the space station provides us

126
00:04:17,590 --> 00:04:15,920
power and data

127
00:04:20,469 --> 00:04:17,600
if we had to provide that on our own if

128
00:04:21,990 --> 00:04:20,479
we decided to make the ams a free-flying

129
00:04:24,469 --> 00:04:22,000
satellite we would have had to have

130
00:04:29,749 --> 00:04:24,479
provided our own communication systems

131
00:04:34,710 --> 00:04:32,790
data systems that that we currently get

132
00:04:36,950 --> 00:04:34,720
from the international space station so

133
00:04:39,189 --> 00:04:36,960
that allowed us to focus the amount of

134
00:04:40,469 --> 00:04:39,199
weight that we had available to launch

135
00:04:41,270 --> 00:04:40,479
into science

136
00:04:43,590 --> 00:04:41,280
so

137
00:04:45,430 --> 00:04:43,600
more detector weight

138
00:04:46,790 --> 00:04:45,440

basically means we get better science

139
00:04:48,469 --> 00:04:46,800
because we're on the international space

140
00:04:50,550 --> 00:04:48,479
station okay

141
00:04:52,550 --> 00:04:50,560
hey we had a couple of twitter questions

142
00:04:54,550 --> 00:04:52,560
we advertised your interview in advance

143
00:04:56,629 --> 00:04:54,560
and we got several different good

144
00:04:59,110 --> 00:04:56,639
questions from folks out there

145
00:05:01,189 --> 00:04:59,120
i'd like to ask you those right now and

146
00:05:02,310 --> 00:05:01,199
and the first one is pretty basic it's

147
00:05:03,830 --> 00:05:02,320
from

148
00:05:04,870 --> 00:05:03,840
cory mcdonald

149
00:05:08,550 --> 00:05:04,880
and

150
00:05:09,670 --> 00:05:08,560
corey asks how many particles has ams

151
00:05:11,990 --> 00:05:09,680
collected

152
00:05:13,749 --> 00:05:12,000
so that's a fairly easy question to

153
00:05:16,230 --> 00:05:13,759
answer and actually you can look for

154
00:05:17,830 --> 00:05:16,240
yourself if you go to ams.nasa.gov

155
00:05:18,950 --> 00:05:17,840
i put a particle counter on the front of

156
00:05:21,110 --> 00:05:18,960
our website

157
00:05:23,830 --> 00:05:21,120
and i just looked just prior to this

158
00:05:25,749 --> 00:05:23,840
interview we are currently at 12.8

159
00:05:28,070 --> 00:05:25,759
billion particles measured

160
00:05:31,350 --> 00:05:28,080
we are measuring at a rate of about 1 to

161
00:05:34,070 --> 00:05:31,360
1.2 billion particles per month

162
00:05:36,950 --> 00:05:34,080
on ams we're measuring particles 24

163
00:05:39,909 --> 00:05:36,960

hours a day 7 days a week 365 days a

164
00:05:43,029 --> 00:05:39,919
year 366 this year

165
00:05:45,350 --> 00:05:43,039
and we have a a cadre of

166
00:05:47,670 --> 00:05:45,360
operations team in geneva that are

167
00:05:49,350 --> 00:05:47,680
constantly monitoring the payload making

168
00:05:51,270 --> 00:05:49,360
sure that thermally and electrically

169
00:05:52,629 --> 00:05:51,280
everything is going smoothly and making

170
00:05:54,150 --> 00:05:52,639
sure that the data is coming down

171
00:05:55,510 --> 00:05:54,160
through the through the proper systems

172
00:05:56,710 --> 00:05:55,520
and making its way to the science

173
00:05:58,870 --> 00:05:56,720
community

174
00:06:01,990 --> 00:05:58,880
and that's billion with a b right a big

175
00:06:03,830 --> 00:06:02,000
b um is that more or less than you ex

176
00:06:06,629 --> 00:06:03,840
we're anticipating we actually are

177
00:06:09,830 --> 00:06:06,639
measuring a a little bit less than two

178
00:06:11,670 --> 00:06:09,840
times what we expected to measure um we

179
00:06:12,870 --> 00:06:11,680
we were a little bit surprised when we

180
00:06:15,510 --> 00:06:12,880
first got up there and we started

181
00:06:17,749 --> 00:06:15,520
measuring data at a rate a little bit

182
00:06:20,469 --> 00:06:17,759
less than twice what we were expecting

183
00:06:22,870 --> 00:06:20,479
we've managed to um

184
00:06:25,110 --> 00:06:22,880
deal with that in our systems we had

185
00:06:26,790 --> 00:06:25,120
some robust capabilities in our systems

186
00:06:28,230 --> 00:06:26,800
that allowed us to handle that we've

187
00:06:30,150 --> 00:06:28,240
done some things to ensure that we're

188
00:06:31,990 --> 00:06:30,160

not overwhelming the space station data

189
00:06:34,230 --> 00:06:32,000
systems

190
00:06:35,909 --> 00:06:34,240
but at times we are using as much as one

191
00:06:38,150 --> 00:06:35,919
third of the bandwidth coming down from

192
00:06:40,629 --> 00:06:38,160
space station uh particularly at night

193
00:06:43,670 --> 00:06:40,639
when we're not downloading video uh we

194
00:06:45,909 --> 00:06:43,680
we can burst down ams data and get it to

195
00:06:49,189 --> 00:06:45,919
the scientists in geneva

196
00:06:51,430 --> 00:06:49,199
wow double the data the next question

197
00:06:52,710 --> 00:06:51,440
comes from uh morgan spice and i'm using

198
00:06:54,469 --> 00:06:52,720
their twitter handles here i don't know

199
00:06:56,469 --> 00:06:54,479
if it's a real name but they're asking

200
00:06:58,390 --> 00:06:56,479
do you think it's possible that our big

201
00:06:59,909 --> 00:06:58,400
bang is just one of many ongoing big

202
00:07:02,070 --> 00:06:59,919
bangs

203
00:07:03,670 --> 00:07:02,080
so that's an interesting question and

204
00:07:05,350 --> 00:07:03,680
ams

205
00:07:08,309 --> 00:07:05,360
most likely will not be able to answer

206
00:07:09,830 --> 00:07:08,319
that question um we can look back almost

207
00:07:11,830 --> 00:07:09,840
to the beginnings of the universe with

208
00:07:12,629 --> 00:07:11,840
ams over the time frame that we expect

209
00:07:13,830 --> 00:07:12,639
to be

210
00:07:15,589 --> 00:07:13,840
on the international space station

211
00:07:18,230 --> 00:07:15,599
essentially longer there the further

212
00:07:20,870 --> 00:07:18,240
back in time you're looking

213
00:07:22,790 --> 00:07:20,880

so with that we can see back to

214
00:07:24,790 --> 00:07:22,800
the origins of this universe maybe back

215
00:07:26,230 --> 00:07:24,800
to the beginnings of this big bang if

216
00:07:28,870 --> 00:07:26,240
there are multiple big bangs we just

217
00:07:29,749 --> 00:07:28,880
won't know that answer from ams

218
00:07:31,830 --> 00:07:29,759
and

219
00:07:34,070 --> 00:07:31,840
you know you talked about the potential

220
00:07:37,189 --> 00:07:34,080
for the instrument um the hubble space

221
00:07:41,350 --> 00:07:37,199
telescope basically rewrote the books on

222
00:07:43,670 --> 00:07:41,360
uh visible and other uh light ranges uh

223
00:07:45,749 --> 00:07:43,680
in astronomy uh do you

224
00:07:47,909 --> 00:07:45,759
anticipate that ams could have that same

225
00:07:49,749 --> 00:07:47,919
kind of uh effect on our understanding

226
00:07:51,270 --> 00:07:49,759
of the universe and uh and our thoughts

227
00:07:53,110 --> 00:07:51,280
about astronomy

228
00:07:56,230 --> 00:07:53,120
so ams at times has been called the

229
00:07:57,749 --> 00:07:56,240
hubble telescope for charged particles

230
00:07:59,670 --> 00:07:57,759
the reason for that is because over the

231
00:08:03,350 --> 00:07:59,680
last 50 years we've done a tremendous

232
00:08:07,110 --> 00:08:05,830
light rays uncharged particles

233
00:08:08,790 --> 00:08:07,120
we haven't done a very good job of

234
00:08:13,189 --> 00:08:08,800
studying charged particles

235
00:08:14,550 --> 00:08:13,199
so with ams we built a system that has

236
00:08:16,869 --> 00:08:14,560
i like to say if you got every high

237
00:08:18,309 --> 00:08:16,879
energy physicist into a room

238
00:08:19,749 --> 00:08:18,319

and you had them

239
00:08:22,070 --> 00:08:19,759
pick out which detector they would put

240
00:08:23,430 --> 00:08:22,080
on a high energy physics experiment

241
00:08:25,589 --> 00:08:23,440
we put all those on a list and we put

242
00:08:28,390 --> 00:08:25,599
them all onto ams

243
00:08:30,309 --> 00:08:28,400
so with that we have the capability to

244
00:08:32,149 --> 00:08:30,319
measure a single particle in multiple

245
00:08:34,230 --> 00:08:32,159
ways usually multiple times with

246
00:08:36,389 --> 00:08:34,240
different detectors so with that we'll

247
00:08:39,430 --> 00:08:36,399
be able to

248
00:08:41,190 --> 00:08:39,440
look at each particle identify it

249
00:08:43,430 --> 00:08:41,200
and ensure that the data that we're

250
00:08:46,150 --> 00:08:43,440
getting is accurate

251
00:08:48,150 --> 00:08:46,160
with that accurate data we hope that

252
00:08:49,829 --> 00:08:48,160
that we'll be able to potentially

253
00:08:51,670 --> 00:08:49,839
redefine what we know as high energy

254
00:08:54,230 --> 00:08:51,680
physics today

255
00:08:55,750 --> 00:08:54,240
and any idea on when we might be able to

256
00:08:57,030 --> 00:08:55,760
hear some of those results i know that

257
00:08:58,310 --> 00:08:57,040
there's a lot of peer review and

258
00:09:00,389 --> 00:08:58,320
everything that goes through that can

259
00:09:02,150 --> 00:09:00,399
you explain that process to us so the

260
00:09:04,470 --> 00:09:02,160
ams collaboration as i mentioned before

261
00:09:07,030 --> 00:09:04,480
is made up of 600 physicist engineers

262
00:09:09,030 --> 00:09:07,040
and technicians from around the world

263
00:09:09,829 --> 00:09:09,040

the way that the the group works is they

264
00:09:10,550 --> 00:09:09,839
take

265
00:09:15,750 --> 00:09:10,560
the

266
00:09:17,910 --> 00:09:15,760
separate physics research uh groups and

267
00:09:19,670 --> 00:09:17,920
they take the data as it comes down the

268
00:09:22,790 --> 00:09:19,680
raw data and each one of them takes the

269
00:09:24,230 --> 00:09:22,800
data and analyzes for particular things

270
00:09:25,750 --> 00:09:24,240
they get back together every once in a

271
00:09:27,269 --> 00:09:25,760
while and say well let's let's look at

272
00:09:28,949 --> 00:09:27,279
this area let's look at that area but

273
00:09:30,790 --> 00:09:28,959
they want an independent verification of

274
00:09:31,990 --> 00:09:30,800
that that's what we do within our own

275
00:09:33,750 --> 00:09:32,000
team

276
00:09:35,750 --> 00:09:33,760
once that is

277
00:09:39,350 --> 00:09:35,760
finalized we

278
00:09:40,630 --> 00:09:39,360
go out for publication and so that will

279
00:09:43,430 --> 00:09:40,640
happen

280
00:09:44,949 --> 00:09:43,440
i don't know when uh at with 12.8

281
00:09:46,310 --> 00:09:44,959
billion particles so far it's a lot of

282
00:09:47,590 --> 00:09:46,320
data to go through

283
00:09:50,070 --> 00:09:47,600
and so

284
00:09:51,190 --> 00:09:50,080
i i certainly would expect that that

285
00:09:53,030 --> 00:09:51,200
sometime

286
00:09:55,190 --> 00:09:53,040
you know within the next year or so we

287
00:09:57,430 --> 00:09:55,200
would have some data coming out

288
00:09:58,710 --> 00:09:57,440

um we certainly have a lot of of

289
00:10:01,350 --> 00:09:58,720
potential

290
00:10:03,509 --> 00:10:01,360
with the 12.8 billion particles

291
00:10:06,069 --> 00:10:03,519
and you're still collecting more

292
00:10:07,670 --> 00:10:06,079
1.2 billion particles a month

293
00:10:09,269 --> 00:10:07,680
okay the last question i'm going to ask

294
00:10:10,790 --> 00:10:09,279
you today and thanks again for being

295
00:10:13,110 --> 00:10:10,800
here is uh

296
00:10:15,430 --> 00:10:13,120
as someone from from humble beginnings

297
00:10:18,470 --> 00:10:15,440
do you have any advice for

298
00:10:20,069 --> 00:10:18,480
kids or students or folks out there that

299
00:10:22,389 --> 00:10:20,079
think they might want to get involved in

300
00:10:24,470 --> 00:10:22,399
this in the future

301
00:10:26,949 --> 00:10:24,480
when you grow up in a small town or even

302
00:10:28,310 --> 00:10:26,959
a big city and and you may have

303
00:10:29,990 --> 00:10:28,320
disadvantages

304
00:10:31,750 --> 00:10:30,000
what do you need to do to

305
00:10:33,030 --> 00:10:31,760
get through school so that you can take

306
00:10:35,350 --> 00:10:33,040
advantage of these kinds of

307
00:10:36,790 --> 00:10:35,360
opportunities that might be out there

308
00:10:38,230 --> 00:10:36,800
yeah the biggest thing that this

309
00:10:40,150 --> 00:10:38,240
question comes up sometimes and the

310
00:10:42,069 --> 00:10:40,160
biggest thing that that i always point

311
00:10:44,949 --> 00:10:42,079
out is you just have to continue

312
00:10:47,590 --> 00:10:44,959
studying your math and science

313
00:10:50,150 --> 00:10:47,600

go get an education in in an engineering

314
00:10:52,389 --> 00:10:50,160
discipline or a science discipline

315
00:10:53,829 --> 00:10:52,399
and go out there and try