
Johnson

1
00:00:06,349 --> 00:00:03,490
good morning and welcome back to the

2
00:00:07,909 --> 00:00:06,359
sts-134 pre-flight briefings here this

3
00:00:10,430 --> 00:00:07,919
hour we're going to have a little more

4
00:00:12,919 --> 00:00:10,440
information on endeavours primary cargo

5
00:00:14,870 --> 00:00:12,929
for the sts-134 mission the Alpha

6
00:00:16,939 --> 00:00:14,880
Magnetic Spectrometer and here to tell

7
00:00:19,730 --> 00:00:16,949
us about that we have a Trent Martin the

8
00:00:21,830 --> 00:00:19,740
NASA AMS manager who's been working to

9
00:00:24,259 --> 00:00:21,840
help the AMS team get the instrument

10
00:00:26,779 --> 00:00:24,269
ready for space and professor Samuel T

11
00:00:28,250 --> 00:00:26,789
the AMS principal investigator and Nobel

12
00:00:30,109 --> 00:00:28,260
laureate and professor of physics at MIT

13
00:00:31,790 --> 00:00:30,119

so we'll start with some opening remarks

14
00:00:35,720 --> 00:00:31,800
from those gentlemen and then take

15
00:00:38,090 --> 00:00:35,730
questions good morning my name is Trent

16
00:00:41,540 --> 00:00:38,100
Martin I am the AMS a project manager

17
00:00:43,450 --> 00:00:41,550
here at the Johnson Space Center AMS is

18
00:00:45,770 --> 00:00:43,460
a large high energy physics experiment

19
00:00:47,869 --> 00:00:45,780
designed to look for antimatter dark

20
00:00:50,119 --> 00:00:47,879
matter and to understand cosmic wave

21
00:00:52,910 --> 00:00:50,129
propagation from its perch on top of the

22
00:00:55,130 --> 00:00:52,920
International Space Station it is a US

23
00:00:58,189 --> 00:00:55,140
Department of Energy sponsored payload

24
00:01:00,319 --> 00:00:58,199
that is flown on on shuttle under a

25
00:01:08,120 --> 00:01:00,329
Memorandum of Understanding between the

26
00:01:12,120 --> 00:01:08,130
Department of Energy and NASA that's the

27
00:01:22,740 --> 00:01:15,179
let me tell you a little bit about the

28
00:01:24,960 --> 00:01:22,750
payload itself so the Department of

29
00:01:26,520 --> 00:01:24,970
Energy relies upon the Massachusetts

30
00:01:30,810 --> 00:01:26,530
Institute of Technology and professor

31
00:01:34,230 --> 00:01:30,820
ting to to develop and cultivate the

32
00:01:37,080 --> 00:01:34,240
collaboration that we that we utilize

33
00:01:40,770 --> 00:01:37,090
for AMS the collaboration is made up of

34
00:01:43,380 --> 00:01:40,780
just about 60 Institute's from 16

35
00:01:46,050 --> 00:01:43,390
different countries each one of those

36
00:01:48,690 --> 00:01:46,060
collaboration members provide financial

37
00:01:51,660 --> 00:01:48,700
support collaboration personnel detector

38
00:01:54,510 --> 00:01:51,670

components science and ground support

39
00:01:57,779 --> 00:01:54,520
equipment operational support scientific

40
00:01:59,130 --> 00:01:57,789
analysis and essentially AMS has as many

41
00:02:00,749 --> 00:01:59,140
countries as the International Space

42
00:02:02,910 --> 00:02:00,759
Station does but we use different

43
00:02:06,600 --> 00:02:02,920
institutes and different agencies than

44
00:02:11,030 --> 00:02:06,610
the ISS does making my job and professor

45
00:02:13,020 --> 00:02:11,040
ting tings job somewhat difficult and

46
00:02:18,660 --> 00:02:13,030
we're having some technical difficulties

47
00:02:22,229 --> 00:02:18,670
so so the responsibilities of my office

48
00:02:24,140 --> 00:02:22,239
here at NASA Johnson Space Center are to

49
00:02:26,640 --> 00:02:24,150
provide payload integration activities

50
00:02:28,140 --> 00:02:26,650
NASA is responsible for providing the

51
00:02:29,910 --> 00:02:28,150
space shuttle ride to the International

52
00:02:32,490 --> 00:02:29,920
Space Station and operations once we're

53
00:02:35,009 --> 00:02:32,500
on the International Space Station we've

54
00:02:37,379 --> 00:02:35,019
been providing continuous support to the

55
00:02:40,559 --> 00:02:37,389
AMS collaboration since 1994 when the

56
00:02:43,920 --> 00:02:40,569
collaboration began we provide numerous

57
00:02:45,930 --> 00:02:43,930
pieces of ground support equipment and

58
00:02:48,449 --> 00:02:45,940
flight support equipment essentially we

59
00:02:50,280 --> 00:02:48,459
take the experiment components that are

60
00:02:52,710 --> 00:02:50,290
provided by the collaboration we

61
00:02:54,270 --> 00:02:52,720
integrate them into NASA built hardware

62
00:02:57,360 --> 00:02:54,280
that that attaches them to the space

63
00:02:59,490 --> 00:02:57,370

station and also to the Space Shuttle we

64
00:03:01,860 --> 00:02:59,500
provide the single point of contact

65
00:03:04,319 --> 00:03:01,870
between the collaboration and the rest

66
00:03:05,940 --> 00:03:04,329
of NASA whether that be the station

67
00:03:08,490 --> 00:03:05,950
program the shuttle program or the

68
00:03:12,089 --> 00:03:08,500
various centers Kennedy Johnson Goddard

69
00:03:14,309 --> 00:03:12,099
etc we have provided specialized test

70
00:03:16,050 --> 00:03:14,319
fixture some specialized transportations

71
00:03:17,610 --> 00:03:16,060
from all places around the world and

72
00:03:18,870 --> 00:03:17,620
professor King will go into the details

73
00:03:22,680 --> 00:03:18,880
of all the different locations around

74
00:03:25,620 --> 00:03:22,690
the world where AMS began and was

75
00:03:27,270 --> 00:03:25,630
constructed we

76
00:03:28,680 --> 00:03:27,280
ensure that the payload is safe for

77
00:03:29,940 --> 00:03:28,690
launch on the space shuttle and safer

78
00:03:32,070 --> 00:03:29,950
operations on the International Space

79
00:03:35,730 --> 00:03:32,080
Station and we provide a mentoring

80
00:03:37,020 --> 00:03:35,740
function for the physicist who in the

81
00:03:39,750 --> 00:03:37,030
beginning weren't very good at building

82
00:03:42,780 --> 00:03:39,760
spaceflight hardware but after this long

83
00:03:45,660 --> 00:03:42,790
are actually fairly good at it so if i

84
00:03:49,110 --> 00:03:45,670
can get picture one up here this picture

85
00:03:51,630 --> 00:03:49,120
shows the AMS sitting on the

86
00:03:56,490 --> 00:03:51,640
International Space Station it weighs

87
00:03:58,170 --> 00:03:56,500
fifteen thousand 251 pounds it takes up

88
00:04:00,660 --> 00:03:58,180

one quarter of the payload Bay in

89
00:04:04,050 --> 00:04:00,670
shuttle Endeavour bye-bye volume about

90
00:04:06,990 --> 00:04:04,060
one-half by mass it will sit on the s3

91
00:04:10,020 --> 00:04:07,000
upper inboard payload attached site on

92
00:04:11,540 --> 00:04:10,030
Space Station and it utilizes the

93
00:04:14,340 --> 00:04:11,550
detector components we have eight

94
00:04:18,090 --> 00:04:14,350
detector components and over 600 onboard

95
00:04:22,290 --> 00:04:18,100
computers to analyze the data in picture

96
00:04:24,150 --> 00:04:22,300
to this is the AMS sitting in the space

97
00:04:26,340 --> 00:04:24,160
station processing facility at the

98
00:04:29,370 --> 00:04:26,350
Kennedy Space Center this picture was

99
00:04:32,700 --> 00:04:29,380
taken a few weeks ago and in picture

100
00:04:35,880 --> 00:04:32,710
three you can see AMS being loaded into

101
00:04:38,550 --> 00:04:35,890
the canister last week as we prepared to

102
00:04:43,110 --> 00:04:38,560
remove to move it out to the pad and in

103
00:04:44,670 --> 00:04:43,120
fact earlier this week we unloaded it

104
00:04:46,830 --> 00:04:44,680
from the canister out of the pad and the

105
00:04:49,260 --> 00:04:46,840
payload change-out room and tomorrow we

106
00:04:52,320 --> 00:04:49,270
intend on putting AMS into the shuttle

107
00:04:55,920 --> 00:04:52,330
endeavour payload bay if you can see

108
00:04:58,590 --> 00:04:55,930
picture for you can get a good idea of

109
00:05:03,240 --> 00:04:58,600
exactly how AMS works essentially what

110
00:05:06,630 --> 00:05:03,250
we're trying to do is detect the charge

111
00:05:09,120 --> 00:05:06,640
of a particle we coupled we essentially

112
00:05:11,610 --> 00:05:09,130
take a large MRI shaped or donut shaped

113
00:05:14,580 --> 00:05:11,620

magnet it's similar to what you would

114
00:05:16,530 --> 00:05:14,590
find in a hospital for MRI turn it

115
00:05:18,510 --> 00:05:16,540
upright we put detectors down through

116
00:05:21,810 --> 00:05:18,520
the center of the of the magnet system

117
00:05:25,320 --> 00:05:21,820
that can tell the a particular particles

118
00:05:26,970 --> 00:05:25,330
mass energy velocity and with coupling

119
00:05:28,410 --> 00:05:26,980
it with the magnetic field we can tell

120
00:05:29,760 --> 00:05:28,420
the charge of the particle so if it's

121
00:05:31,710 --> 00:05:29,770
positively charged it bends one

122
00:05:33,120 --> 00:05:31,720
direction in the magnetic field if it's

123
00:05:36,200 --> 00:05:33,130
negatively charged it bends the other

124
00:05:40,700 --> 00:05:36,210
direction in the magnetic field

125
00:05:43,159 --> 00:05:40,710
next feature be okay if we can pull up

126
00:05:46,070 --> 00:05:43,169
animation number one I can't see the

127
00:05:49,150 --> 00:05:46,080
animations over here your pulp animation

128
00:05:54,680 --> 00:05:49,160
of one this is the AMS detector itself

129
00:05:55,850 --> 00:05:54,690
as its rotating around the the first

130
00:05:57,439 --> 00:05:55,860
thing that you're going to see here this

131
00:05:59,089 --> 00:05:57,449
is the unique support structure this is

132
00:06:00,589 --> 00:05:59,099
the NASA built hardware that it provides

133
00:06:03,950 --> 00:06:00,599
the interface between the determine

134
00:06:05,930 --> 00:06:03,960
detector and the space shuttle this is

135
00:06:07,850 --> 00:06:05,940
the magnet system that provides us the

136
00:06:12,260 --> 00:06:07,860
capability of detecting the charge of

137
00:06:13,790 --> 00:06:12,270
the particles this is the payload tap

138
00:06:15,589 --> 00:06:13,800

system and the umbilical mechanism

139
00:06:17,300 --> 00:06:15,599
assembly these provide us the mechanical

140
00:06:19,640 --> 00:06:17,310
electrical interfaces to this to the

141
00:06:21,740 --> 00:06:19,650
station this is a transition radiation

142
00:06:23,810 --> 00:06:21,750
detector the uppermost detector of AMS

143
00:06:25,249 --> 00:06:23,820
the time of flight systems which allow

144
00:06:27,890 --> 00:06:25,259
us to detect the velocity of the

145
00:06:29,570 --> 00:06:27,900
particles the tracker system which is

146
00:06:31,040 --> 00:06:29,580
down through the bore of the of the

147
00:06:33,350 --> 00:06:31,050
magnet system and allows us to

148
00:06:37,210 --> 00:06:33,360
accurately define the path of the

149
00:06:39,529 --> 00:06:37,220
particles the video counter allows us to

150
00:06:40,969 --> 00:06:39,539
eliminate particles coming in from the

151
00:06:42,980 --> 00:06:40,979
side down at the bottom we have the ring

152
00:06:45,350 --> 00:06:42,990
imaging shrink off counter and the

153
00:06:50,029 --> 00:06:45,360
electromagnetic calorimeter is the last

154
00:06:51,950 --> 00:06:50,039
detector of AMS all of that data goes

155
00:06:53,300 --> 00:06:51,960
out to the radiators and electronic

156
00:06:57,080 --> 00:06:53,310
systems which are mounted out on the

157
00:06:59,270 --> 00:06:57,090
outside edges of AMS and so that's a

158
00:07:02,860 --> 00:06:59,280
quick overview of what of what professor

159
00:07:08,120 --> 00:07:05,409
when one thing I might note about the

160
00:07:11,060 --> 00:07:08,130
permanent magnet that we're using on AMS

161
00:07:14,510 --> 00:07:11,070
is it does not interfere with any

162
00:07:18,760 --> 00:07:14,520
passing e VA or EVR da crew members or

163
00:07:28,060 --> 00:07:22,730

okay I think we have one more animation

164
00:07:32,830 --> 00:07:31,390
okay so once ARS is launched on the on

165
00:07:34,300 --> 00:07:32,840
the endeavor and makes its way to the

166
00:07:36,160 --> 00:07:34,310
International Space Station we will

167
00:07:39,220 --> 00:07:36,170
utilize the space shuttle arm to pick a

168
00:07:42,460 --> 00:07:39,230
ms up out of the payload Bay we do an

169
00:07:44,020 --> 00:07:42,470
armed arm hand off where we use the

170
00:07:47,320 --> 00:07:44,030
space station arm to reach over and grab

171
00:07:49,380 --> 00:07:47,330
the AMS using graph two different sets

172
00:07:53,350 --> 00:07:49,390
of grapple fixtures that we have on AMS

173
00:07:58,810 --> 00:07:53,360
once we do the handoff we move it over

174
00:08:02,920 --> 00:07:58,820
into position above the s3 truss and we

175
00:08:04,980 --> 00:08:02,930
will drop it down well hopefully I drop

176
00:08:08,920 --> 00:08:04,990
it down we'll set it down gently onto

177
00:08:11,320 --> 00:08:08,930
the International Space Station once in

178
00:08:13,120 --> 00:08:11,330
place we connect through through the

179
00:08:16,570 --> 00:08:13,130
umbilical mechanism assembly and attach

180
00:08:19,870 --> 00:08:16,580
it electrically for electrical and data

181
00:08:23,200 --> 00:08:19,880
purposes to the space station once on

182
00:08:27,100 --> 00:08:23,210
space station we turn on AMS almost

183
00:08:29,260 --> 00:08:27,110
immediately will will prepare the system

184
00:08:31,660 --> 00:08:29,270
for taking scientific data and we can

185
00:08:34,480 --> 00:08:31,670
actually be taking data as soon as the

186
00:08:38,080 --> 00:08:34,490
power comes on to AMS so within within a

187
00:08:42,640 --> 00:08:38,090
few minutes actually I think that's the

188
00:08:45,100 --> 00:08:42,650

last animation that I had I will now

189
00:08:47,920 --> 00:08:45,110
leave the rest of the discussion of

190
00:08:50,190 --> 00:08:47,930
science to the scientist and I'll turn

191
00:08:52,870 --> 00:08:50,200
it over to Professor Samuel ting

192
00:08:54,100 --> 00:08:52,880
professor tang is a Nobel laureate from

193
00:08:56,590 --> 00:08:54,110
the Massachusetts Institute of

194
00:08:58,360 --> 00:08:56,600
Technology he's been leading the AMS

195
00:09:01,360 --> 00:08:58,370
collaboration since its inception in

196
00:09:02,830 --> 00:09:01,370
1994 it's been a great pleasure to work

197
00:09:07,870 --> 00:09:02,840
with him I've been working with him

198
00:09:14,700 --> 00:09:07,880
since 1995 on AMS and I'll let professor

199
00:09:23,920 --> 00:09:19,180
it's nice to be here today I actually

200
00:09:26,160 --> 00:09:23,930
got a good batch I can tell me what I

201
00:09:29,129 --> 00:09:26,170
would like no first

202
00:09:34,550 --> 00:09:29,139
what I would like to do today is to

203
00:09:39,509 --> 00:09:34,560
share with you the signs and the

204
00:09:42,710 --> 00:09:39,519
construction of a AMS the first thing

205
00:09:46,110 --> 00:09:42,720
you need to realize in physics

206
00:09:50,400 --> 00:09:46,120
everything appear to be complicated but

207
00:09:53,939 --> 00:09:50,410
the basic idea is always very simple and

208
00:10:00,210 --> 00:09:53,949
I hope I can transmit this impression to

209
00:10:06,540 --> 00:10:00,220
you so AMS will be the only large

210
00:10:13,230 --> 00:10:06,550
physical science experiment on the US is

211
00:10:17,220 --> 00:10:13,240
s national laboratory next one so what

212
00:10:20,879 --> 00:10:17,230
on this picture is shows the largest

213
00:10:24,060 --> 00:10:20,889

accelerator in the world course earn it

214
00:10:27,870 --> 00:10:24,070
has a circumference of 16 miles it's

215
00:10:32,180 --> 00:10:27,880
about the hundred meter to 300 meter

216
00:10:37,889 --> 00:10:32,190
underground and inside they are a

217
00:10:41,130 --> 00:10:37,899
thousand magnet cool to near absolute

218
00:10:44,990 --> 00:10:41,140
zero temperature at that temperature

219
00:10:47,550 --> 00:10:45,000
Adams no longer move in the wire so

220
00:10:50,610 --> 00:10:47,560
electricity can go through without

221
00:10:53,360 --> 00:10:50,620
resistance still that what you call

222
00:10:56,670 --> 00:10:53,370
super conductivity and you are able to

223
00:11:00,540 --> 00:10:56,680
move large amount of current therefore

224
00:11:09,030 --> 00:11:00,550
generate very high magnetic field bit

225
00:11:12,170 --> 00:11:09,040
not yet no please I would care so this

226
00:11:16,620 --> 00:11:12,180
accelerator it's on the border between

227
00:11:22,559 --> 00:11:16,630
France and Switzerland and it this is

228
00:11:28,970 --> 00:11:22,569
the place where the entire experiment

229
00:11:38,070 --> 00:11:34,250
this accelerator at CERN produce

230
00:11:45,510 --> 00:11:38,080
particles of seven trilling electron

231
00:11:49,280 --> 00:11:45,520
volt but in space high-energy particles

232
00:11:53,580 --> 00:11:49,290
has been detected he has an energy of

233
00:11:56,970 --> 00:11:53,590
100 million trillion electron volt so

234
00:12:01,440 --> 00:11:56,980
100 million truly electron volt is much

235
00:12:05,100 --> 00:12:01,450
larger than 7 training units a lot this

236
00:12:08,660 --> 00:12:05,110
means no matter how large external be to

237
00:12:12,480 --> 00:12:08,670
build on earth you cannot compete with

238
00:12:17,160 --> 00:12:12,490

cosmos and this madam this experiment

239
00:12:20,270 --> 00:12:17,170
was done with a detector with area the

240
00:12:25,020 --> 00:12:20,280
size of 10 times the city of Paris

241
00:12:27,960 --> 00:12:25,030
measuring a primary cosmic ray n 2 into

242
00:12:30,510 --> 00:12:27,970
the atmosphere broke it apart and so you

243
00:12:32,670 --> 00:12:30,520
measure the second erase you add up the

244
00:12:35,940 --> 00:12:32,680
secondary particles you know what a

245
00:12:40,320 --> 00:12:35,950
primary particle energy is so the most

246
00:12:46,020 --> 00:12:40,330
important ideas highest energy particle

247
00:12:50,220 --> 00:12:46,030
is always produced in the cosmos now

248
00:12:53,190 --> 00:12:50,230
this experiment as twin deficit is a US

249
00:12:56,280 --> 00:12:53,200
Department of Energy led international

250
00:13:01,680 --> 00:12:56,290
collaboration the consists of 16

251
00:13:07,080 --> 00:13:01,690
countries 600 physicists it took us

252
00:13:11,450 --> 00:13:07,090
nearly 17 years Nadia decide United

253
00:13:13,650 --> 00:13:11,460
States made your country include Germany

254
00:13:17,880 --> 00:13:13,660
enormous amount of work in fact the

255
00:13:21,480 --> 00:13:17,890
director of the most important Institute

256
00:13:25,579 --> 00:13:21,490
in Germany purpose of shale is in here

257
00:13:30,380 --> 00:13:25,589
and the question you can also ask him

258
00:13:37,020 --> 00:13:30,390
then there's France Italy Spain Portugal

259
00:13:37,400 --> 00:13:37,030
Russia far is particularly Taiwan which

260
00:13:46,629 --> 00:13:37,410
may

261
00:13:52,910 --> 00:13:46,639
the enormous amount of contribution the

262
00:13:57,230 --> 00:13:52,920
realization of AMS depends on three

263
00:14:01,249 --> 00:13:57,240

factors the most important is the strong

264
00:14:08,650 --> 00:14:01,259
important endorsement of AMS signs from

265
00:14:17,240 --> 00:14:13,519
second is a unanimous support from the

266
00:14:22,400 --> 00:14:17,250
United States Senate and House answer

267
00:14:27,530 --> 00:14:22,410
major word support from in Germany from

268
00:14:32,389 --> 00:14:27,540
from the German space agency from the

269
00:14:35,019 --> 00:14:32,399
German equivalent of MIT our WTH from

270
00:14:39,800 --> 00:14:35,029
France from french space agency from

271
00:14:44,150 --> 00:14:39,810
spanish space agency from the Swiss ETH

272
00:14:46,519 --> 00:14:44,160
that the very famous school I'm from the

273
00:14:49,999 --> 00:14:46,529
switch National Foundation and from

274
00:14:54,199 --> 00:14:50,009
Italy from the Institute of Physics infn

275
00:14:58,519 --> 00:14:54,209
and from the Italian space agency an

276
00:15:03,290 --> 00:14:58,529
entire one form a military institute

277
00:15:07,780 --> 00:15:03,300
course es IST in united states we

278
00:15:13,780 --> 00:15:07,790
enjoyed very strong support from lhasa

279
00:15:19,639 --> 00:15:13,790
from the ue as we're us from MIT in

280
00:15:22,490 --> 00:15:19,649
addition we are strongly supported by

281
00:15:24,199 --> 00:15:22,500
the european space agency and by the

282
00:15:33,439 --> 00:15:24,209
european organization for nuclear

283
00:15:36,439 --> 00:15:33,449
research cern so this experiment was

284
00:15:40,400 --> 00:15:36,449
reviewed many many times by the

285
00:15:44,059 --> 00:15:40,410
department of energy and then we do most

286
00:15:46,280 --> 00:15:44,069
of reviewers are Nobel Prize winners a

287
00:15:47,540 --> 00:15:46,290
member of the National Academy of

288
00:15:50,600 --> 00:15:47,550

Science

289
00:15:54,930 --> 00:15:50,610
when we were discussing this experiment

290
00:16:02,940 --> 00:15:54,940
with the Department of Energy in

291
00:16:09,150 --> 00:16:02,950
nineteen sixty 19-8 1995 I request to do

292
00:16:11,460 --> 00:16:09,160
e to choose the best physicist to review

293
00:16:13,700 --> 00:16:11,470
this experiment because it's a unique

294
00:16:17,700 --> 00:16:13,710
seen people have not done before and

295
00:16:24,650 --> 00:16:17,710
therefore it is very important the most

296
00:16:37,590 --> 00:16:30,390
NASA provide very strong support of AMS

297
00:16:39,780 --> 00:16:37,600
from headquarters from guardar from

298
00:16:43,280 --> 00:16:39,790
Kennedy Space Center Marshall Space

299
00:16:50,930 --> 00:16:43,290
Center Johnson's Johnson Space Center

300
00:16:56,460 --> 00:16:50,940
and also aims and loss administrators

301
00:17:00,560 --> 00:16:56,470
dangling Charlie Bolden of the lori

302
00:17:03,690 --> 00:17:00,570
garver george IV anbus per customer all

303
00:17:06,630 --> 00:17:03,700
stone supported this experiment I think

304
00:17:09,600 --> 00:17:06,640
if my memory is correct mr. gates to

305
00:17:15,390 --> 00:17:09,610
meijer must have visited us eight or

306
00:17:18,390 --> 00:17:15,400
nine times NASA provide to shuttle

307
00:17:27,230 --> 00:17:18,400
flight for us even though this is not a

308
00:17:33,900 --> 00:17:27,240
NASA experiment and also allow us to use

309
00:17:39,240 --> 00:17:33,910
the space station most important NASA

310
00:17:43,710 --> 00:17:39,250
provide mission management group the

311
00:17:48,510 --> 00:17:43,720
NASA apo of mr. turn martin and came

312
00:17:53,789 --> 00:17:48,520
boeing we educated us how to do

313
00:18:01,840 --> 00:17:57,520

this experiment in United States also

314
00:18:05,590 --> 00:18:01,850
receive very strong support from the

315
00:18:09,640 --> 00:18:05,600
Department of Energy us where us from

316
00:18:16,659 --> 00:18:09,650
the school of signs of MIT this

317
00:18:19,840 --> 00:18:16,669
experiment was proposed started with MIT

318
00:18:24,029 --> 00:18:19,850
and they might in lead and coordinate

319
00:18:27,940 --> 00:18:24,039
this experiment it is a Mikey group

320
00:18:34,419 --> 00:18:27,950
design and construct most of the

321
00:18:40,620 --> 00:18:34,429
electronic system and also work on the

322
00:18:51,070 --> 00:18:46,680
so when you look a particle detector it

323
00:18:54,399 --> 00:18:51,080
always looks very complicated so there

324
00:18:57,060 --> 00:18:54,409
are many layers the first layer is

325
00:19:00,130 --> 00:18:57,070
called translation radiation detector

326
00:19:03,730 --> 00:19:00,140
imagines the electrons and positrons and

327
00:19:09,279 --> 00:19:03,740
then they are followed by time of lie

328
00:19:12,970 --> 00:19:09,289
detector mallu the energy and nuclear

329
00:19:16,419 --> 00:19:12,980
charge and then you have put nine layer

330
00:19:21,279 --> 00:19:16,429
of silicon detector total area of six

331
00:19:24,130 --> 00:19:21,289
points two square meters module the

332
00:19:27,279 --> 00:19:24,140
nuclear charge and the sign of the

333
00:19:30,430 --> 00:19:27,289
charge in a magnetic field and then you

334
00:19:36,220 --> 00:19:30,440
have another detector called rich in my

335
00:19:39,340 --> 00:19:36,230
today energy and charge and then at the

336
00:19:42,669 --> 00:19:39,350
bottom you have another detector called

337
00:19:45,789 --> 00:19:42,679
electromagnetic detector images the

338
00:19:51,279 --> 00:19:45,799

energy of your lectern passacantando

339
00:19:54,450 --> 00:19:51,289
Marie's this means most of the

340
00:19:57,340 --> 00:19:54,460
properties are measured repeatedly just

341
00:20:01,500 --> 00:19:57,350
to make sure they are consistent with

342
00:20:04,410 --> 00:20:01,510
each other so

343
00:20:07,590 --> 00:20:04,420
or a particle goes through these

344
00:20:12,380 --> 00:20:07,600
different detectors he leaves different

345
00:20:19,020 --> 00:20:12,390
traces and you can quickly identify them

346
00:20:23,220 --> 00:20:19,030
next one the magnet is a permanent

347
00:20:29,000 --> 00:20:23,230
magnet he was provided by the united

348
00:20:34,140 --> 00:20:29,010
states department of energy and was

349
00:20:36,720 --> 00:20:34,150
manufactured in china or italy in

350
00:20:39,930 --> 00:20:36,730
nineteen ninety six or so and the reason

351
00:20:43,830 --> 00:20:39,940
is the best permanent magnet material

352
00:20:48,090 --> 00:20:43,840
come from Inner Mongolia which is part

353
00:20:55,850 --> 00:20:48,100
of time I would say they really did a

354
00:21:05,790 --> 00:21:00,780
since cosmic rays going in all random

355
00:21:10,200 --> 00:21:05,800
direction so you need a counter a ring

356
00:21:12,900 --> 00:21:10,210
of conquer surround your acceptance

357
00:21:16,260 --> 00:21:12,910
detector and so particle going from the

358
00:21:18,870 --> 00:21:16,270
random are rejected so you wanted to

359
00:21:24,330 --> 00:21:18,880
this very efficiently you wonder if a

360
00:21:27,540 --> 00:21:24,340
sincere pouring 99999 and that is very

361
00:21:33,450 --> 00:21:27,550
very difficult to do and this was done

362
00:21:38,160 --> 00:21:33,460
in often Germany took the many years to

363
00:21:41,760 --> 00:21:38,170

build this next one oh this is a picture

364
00:21:43,620 --> 00:21:41,770
or you don't see picture only see me the

365
00:21:47,610 --> 00:21:43,630
picture is more the picture there is

366
00:21:52,520 --> 00:21:47,620
more exciting picture shows how this

367
00:21:56,280 --> 00:21:52,530
detector is manufactured next one

368
00:21:59,910 --> 00:21:56,290
another detector is measure the flight

369
00:22:02,760 --> 00:21:59,920
time make sure the particle you only

370
00:22:08,880 --> 00:22:02,770
measure that up-and-down particle next

371
00:22:11,970 --> 00:22:08,890
one a major detector that is made in

372
00:22:14,680 --> 00:22:11,980
Germany which the participation United

373
00:22:17,770 --> 00:22:14,690
States and Italy is called

374
00:22:21,310 --> 00:22:17,780
in radiation detector it used the fact

375
00:22:26,100 --> 00:22:21,320
when you have an electron goes through

376
00:22:29,350 --> 00:22:26,110
layers already a radiation material and

377
00:22:34,390 --> 00:22:29,360
then go through the boundary we emit

378
00:22:38,830 --> 00:22:34,400
light rays and measurement of this gamma

379
00:22:42,270 --> 00:22:38,840
ray shows AG electron as go through no

380
00:22:46,450 --> 00:22:42,280
other particle give this phenomenal and

381
00:22:50,140 --> 00:22:46,460
so the difficulty thing is to how to

382
00:22:56,250 --> 00:22:50,150
detect this gamma rays to do that we

383
00:23:00,580 --> 00:22:56,260
developed mostly in Germany 9000

384
00:23:03,310 --> 00:23:00,590
detectors but in space you can now do

385
00:23:06,760 --> 00:23:03,320
refill so you have to make sure this

386
00:23:11,920 --> 00:23:06,770
detector are centered correctly and they

387
00:23:18,640 --> 00:23:11,930
do not leak and so out of this 9000 we

388
00:23:22,510 --> 00:23:18,650

build we put some of them I'd not in a

389
00:23:26,320 --> 00:23:22,520
hospital in your cat scan machine to

390
00:23:29,890 --> 00:23:26,330
make sure the detection center incident

391
00:23:34,750 --> 00:23:29,900
the wire is entered correctly and from

392
00:23:40,090 --> 00:23:34,760
the 9000 bill which was 5248 of them and

393
00:23:44,140 --> 00:23:40,100
they are centered 200 micro and they are

394
00:23:48,810 --> 00:23:44,150
leaked tight so when we carry five

395
00:23:52,540 --> 00:23:48,820
kilogram of co2 and 50 kilogram of xena

396
00:23:55,330 --> 00:23:52,550
we were last for 30 years so perhaps

397
00:23:58,120 --> 00:23:55,340
longer than the space station and we

398
00:24:01,090 --> 00:23:58,130
have done extensive tests to make sure

399
00:24:04,150 --> 00:24:01,100
this detector which is one that most

400
00:24:07,330 --> 00:24:04,160
important detector will last for more

401
00:24:12,850 --> 00:24:07,340
than 30 years in space we loud review

402
00:24:16,980 --> 00:24:12,860
and this picture you cannot see if you

403
00:24:19,660 --> 00:24:16,990
look back on their heels the group of a

404
00:24:23,290 --> 00:24:19,670
large group of people and a professor

405
00:24:25,590 --> 00:24:23,300
share one to ten years to build this

406
00:24:35,620 --> 00:24:25,600
detector

407
00:24:39,280 --> 00:24:35,630
silicon layers total six points 2 square

408
00:24:42,880 --> 00:24:39,290
meters in nine layers and they can

409
00:24:46,140 --> 00:24:42,890
measure the coordinate the position of

410
00:24:50,350 --> 00:24:46,150
the particle to one-tenth of your hair

411
00:24:55,080 --> 00:24:50,360
and so these were done in special

412
00:24:58,870 --> 00:24:55,090
laboratory in Switzerland and the

413
00:25:03,730 --> 00:24:58,880

microscope as well as special

414
00:25:07,990 --> 00:25:03,740
laboratories in Italy yes taking 50

415
00:25:15,310 --> 00:25:08,000
engineers three years to build this

416
00:25:19,570 --> 00:25:15,320
detector and this is how the detector is

417
00:25:22,570 --> 00:25:19,580
installed can I see it again they're

418
00:25:32,740 --> 00:25:22,580
installed into the magnet a total nine

419
00:25:38,200 --> 00:25:32,750
layers another detector is May in Spain

420
00:25:40,840 --> 00:25:38,210
in France I etely in other words if you

421
00:25:44,830 --> 00:25:40,850
speak not in type of language you work

422
00:25:47,370 --> 00:25:44,840
this detective and the previous detector

423
00:25:51,870 --> 00:25:47,380
better you speak German

424
00:25:55,020 --> 00:25:51,880
and no not yet not yet nya and this

425
00:25:57,600 --> 00:25:55,030
detector and used the fact on a charged

426
00:26:01,320 --> 00:25:57,610
particle goes through the top of the

427
00:26:04,820 --> 00:26:01,330
detector in amisha light and the angle

428
00:26:11,310 --> 00:26:04,830
of the light is a measurement of full

429
00:26:13,890 --> 00:26:11,320
velocity velocity means energy and the

430
00:26:16,380 --> 00:26:13,900
intensity of the light is the

431
00:26:19,580 --> 00:26:16,390
measurement of nuclear charge you know

432
00:26:22,620 --> 00:26:19,590
throughout the periodic table there's a

433
00:26:25,430 --> 00:26:22,630
hydrogen has one proton helium has two

434
00:26:29,310 --> 00:26:25,440
protons so the chart is always integrals

435
00:26:34,290 --> 00:26:29,320
you will not have a fractional charge so

436
00:26:38,610 --> 00:26:34,300
you just identify the charge next one so

437
00:26:48,750 --> 00:26:38,620
this detector is very nicely made it has

438
00:26:52,410 --> 00:26:48,760

a 11,000 photosensors next one another

439
00:26:56,490 --> 00:26:52,420
detector is called the electromagnetic

440
00:27:01,020 --> 00:26:56,500
calorimeter is used the fact electrons

441
00:27:04,140 --> 00:27:01,030
and light rays because has a very small

442
00:27:06,630 --> 00:27:04,150
mass so you when you enter into a piece

443
00:27:10,050 --> 00:27:06,640
of lead you quickly loss its energy and

444
00:27:12,930 --> 00:27:10,060
if you pick up the energy by optical

445
00:27:15,600 --> 00:27:12,940
fibers then you know a lee electron as

446
00:27:19,410 --> 00:27:15,610
of you and you can measure the energy of

447
00:27:22,410 --> 00:27:19,420
the electron to do this and this was a

448
00:27:28,350 --> 00:27:22,420
technique for this special one develop

449
00:27:30,570 --> 00:27:28,360
the in pisa and they are next one so

450
00:27:33,720 --> 00:27:30,580
this is how this will be our did this

451
00:27:36,780 --> 00:27:33,730
degree this is not making spaghetti but

452
00:27:39,750 --> 00:27:36,790
it's very similar and shows people

453
00:27:43,160 --> 00:27:39,760
making very thin piece of let a

454
00:27:48,030 --> 00:27:43,170
millimeter and with my millimeter

455
00:27:52,830 --> 00:27:48,040
optical fibers in total in total they

456
00:27:56,130 --> 00:27:52,840
are 1200 pound of lead for yours and

457
00:27:57,550 --> 00:27:56,140
which 10,000 optical fiber by

458
00:28:02,470 --> 00:27:57,560
millimeters thick

459
00:28:06,670 --> 00:28:02,480
next one so this is the electromagnetic

460
00:28:08,950 --> 00:28:06,680
calorimeter and these the most sensitive

461
00:28:11,950 --> 00:28:08,960
why he has something called radiation

462
00:28:17,230 --> 00:28:11,960
aims at 17 radiation is it's the most

463
00:28:21,790 --> 00:28:17,240

sensitive one every build for space next

464
00:28:25,590 --> 00:28:21,800
one so we think you are very strong

465
00:28:31,420 --> 00:28:25,600
support from the European Space Agency

466
00:28:36,430 --> 00:28:31,430
last year this time we were not here we

467
00:28:39,690 --> 00:28:36,440
were in Harlem we put the detector into

468
00:28:43,720 --> 00:28:39,700
the thermal vacuum chamber and to

469
00:28:46,480 --> 00:28:43,730
simulate the space condition to make

470
00:28:50,440 --> 00:28:46,490
sure the detector will work in vacuum

471
00:28:59,250 --> 00:28:50,450
and work in space temperature range will

472
00:29:05,680 --> 00:28:59,260
their perform a next one and then we put

473
00:29:09,610 --> 00:29:05,690
the detector into an accelerator this is

474
00:29:12,760 --> 00:29:09,620
accelerator complex observer the largest

475
00:29:17,590 --> 00:29:12,770
one has 27 kilometer the second largest

476
00:29:21,130 --> 00:29:17,600
one is a seven kilometer and we will put

477
00:29:24,610 --> 00:29:21,140
into the seven kilometer accelerator to

478
00:29:31,050 --> 00:29:24,620
sim to produce particles to sit to see

479
00:29:35,730 --> 00:29:31,060
the response of particles in space and

480
00:29:40,180 --> 00:29:35,740
so this is why this detector look like

481
00:29:44,740 --> 00:29:40,190
in space on the age to the twentieth of

482
00:29:47,890 --> 00:29:44,750
August I should mention even though

483
00:29:51,540 --> 00:29:47,900
we'll have a very large group we do have

484
00:29:55,300 --> 00:29:51,550
a very strong engineering support and so

485
00:30:00,580 --> 00:29:55,310
the time sequence is a very well kept

486
00:30:03,700 --> 00:30:00,590
and we have a very good supporting from

487
00:30:07,450 --> 00:30:03,710
Johnson Space Center who always make

488
00:30:09,050 --> 00:30:07,460

sure that every day what is done is

489
00:30:16,250 --> 00:30:09,060
carried out

490
00:30:25,200 --> 00:30:16,260
next one up after the detector was

491
00:30:29,160 --> 00:30:25,210
finished we could not see the detector

492
00:30:34,020 --> 00:30:29,170
into a Boeing 747 because unless we take

493
00:30:40,320 --> 00:30:34,030
it apart and that is not a good idea and

494
00:30:43,470 --> 00:30:40,330
so we were able through the support of

495
00:30:50,820 --> 00:30:43,480
NASA and slew the supportive Department

496
00:30:59,460 --> 00:30:50,830
energy obtained a Air Force e5 to

497
00:31:09,730 --> 00:31:03,970
this trend has shown a mess in kennedy

498
00:31:14,790 --> 00:31:09,740
space center next one so there are many

499
00:31:18,940 --> 00:31:14,800
discussions or in the past about what

500
00:31:21,490 --> 00:31:18,950
weather is possible to build to do

501
00:31:24,460 --> 00:31:21,500
fundamental science on the space station

502
00:31:27,730 --> 00:31:24,470
you often heard people say well the

503
00:31:30,580 --> 00:31:27,740
spacing is a good adventure to learn to

504
00:31:35,500 --> 00:31:30,590
live in space and what could he do for

505
00:31:39,010 --> 00:31:35,510
science what you can contribute unsigned

506
00:31:42,820 --> 00:31:39,020
can be very simply understood in the

507
00:31:45,970 --> 00:31:42,830
following way in space there are two

508
00:31:49,690 --> 00:31:45,980
type of cosmic rays one doesn't carry

509
00:31:54,460 --> 00:31:49,700
chart like light ways like neutrinos and

510
00:31:57,220 --> 00:31:54,470
this has been studied over 50 years in

511
00:32:00,370 --> 00:31:57,230
fact all or understanding about cosmos

512
00:32:03,910 --> 00:32:00,380
come from observation of libraries in

513
00:32:07,630 --> 00:32:03,920

neutrinos but beside libraries and

514
00:32:11,380 --> 00:32:07,640
neutrinos they are particles carry

515
00:32:14,830 --> 00:32:11,390
charge once the carry chart we must have

516
00:32:17,740 --> 00:32:14,840
a mass one chef Amar's is absorbed in

517
00:32:20,530 --> 00:32:17,750
Earth's atmosphere so you never never

518
00:32:23,320 --> 00:32:20,540
measure the original cosmic ray on the

519
00:32:27,280 --> 00:32:23,330
ground because you live under 60 buyer

520
00:32:31,090 --> 00:32:27,290
support of artemis figure which is you

521
00:32:35,140 --> 00:32:31,100
could have 30 feet of water so you have

522
00:32:38,200 --> 00:32:35,150
to go to space now because it carries a

523
00:32:41,650 --> 00:32:38,210
charge you need a magnet because

524
00:32:45,730 --> 00:32:41,660
positive Ben's one way negative Benton

525
00:32:48,760 --> 00:32:45,740
also way but put a magnet in space as a

526
00:32:52,120 --> 00:32:48,770
wine small difficulty and that is you

527
00:32:54,610 --> 00:32:52,130
have a magnetic compass one in the world

528
00:32:56,920 --> 00:32:54,620
or ignores the other in the Wolves go

529
00:32:59,560 --> 00:32:56,930
south so if you're not careful you put a

530
00:33:04,290 --> 00:32:59,570
lot magazine space so your shelter will

531
00:33:08,410 --> 00:33:04,300
lose control and took a long time to

532
00:33:11,020 --> 00:33:08,420
figure out to design a magnet internal

533
00:33:12,850 --> 00:33:11,030
rotation space or the field are inside

534
00:33:16,350 --> 00:33:12,860
looking from outside

535
00:33:20,970 --> 00:33:16,360
like a beer okay okay so he doesn't move

536
00:33:27,730 --> 00:33:20,980
and so home I've first explained this to

537
00:33:33,340 --> 00:33:27,740
mr. Golding in 90 in let me think you

538
00:33:38,080 --> 00:33:33,350

must be May night 1994 and he said well

539
00:33:41,610 --> 00:33:38,090
this is a fine but why don't we try your

540
00:33:43,960 --> 00:33:41,620
little idea on a space shuttle first

541
00:33:46,510 --> 00:33:43,970
just to make sure everything will be

542
00:33:48,700 --> 00:33:46,520
okay and that's why we have our first

543
00:33:51,400 --> 00:33:48,710
flight the first flight was an

544
00:33:55,690 --> 00:33:51,410
engineering flight with with the same

545
00:33:58,690 --> 00:33:55,700
magnet with about the same area of

546
00:34:01,750 --> 00:33:58,700
detectors but less detectors and we

547
00:34:05,950 --> 00:34:01,760
function perfectly and that's why give

548
00:34:11,500 --> 00:34:05,960
us confidence we can use this magnet in

549
00:34:17,909 --> 00:34:11,510
the teaching we have keep this magnet in

550
00:34:23,260 --> 00:34:17,919
the air-conditioned area and so from

551
00:34:25,419 --> 00:34:23,270
1997 to now 12 years has passed more

552
00:34:28,389 --> 00:34:25,429
than 12 years the past will measure the

553
00:34:31,840 --> 00:34:28,399
magnetic field the magnetic view has not

554
00:34:35,619 --> 00:34:31,850
changed at all but this means this

555
00:34:42,430 --> 00:34:35,629
magnet can work on the space station for

556
00:34:46,899 --> 00:34:42,440
a period of 20 to 30 years so while the

557
00:34:50,470 --> 00:34:46,909
things you can measure the cows the

558
00:34:54,450 --> 00:34:50,480
array of for Complementary and precision

559
00:35:00,040 --> 00:34:54,460
detectors is all the current cosmic rays

560
00:35:03,760 --> 00:35:00,050
from hydrogen to helium and all the way

561
00:35:07,450 --> 00:35:03,770
go up the periodic table you measure to

562
00:35:12,609 --> 00:35:07,460
an accuracy of one percent over the

563
00:35:16,980 --> 00:35:12,619

entire solar cycle cycle this is very

564
00:35:21,880 --> 00:35:16,990
important in future if men want to leave

565
00:35:25,270 --> 00:35:21,890
the planet go to Mars go to moon

566
00:35:28,840 --> 00:35:25,280
there is a question radiation now the

567
00:35:31,960 --> 00:35:28,850
radiation it really is not know there

568
00:35:34,720 --> 00:35:31,970
has been balloon measurement satellite

569
00:35:38,560 --> 00:35:34,730
measurement with a large errors thirty

570
00:35:42,070 --> 00:35:38,570
percent errors which one percent error

571
00:35:44,800 --> 00:35:42,080
major all the nuclei follow the entire

572
00:35:48,360 --> 00:35:44,810
solar cycle will be done for the first

573
00:35:51,420 --> 00:35:48,370
time we have calibrated detector in

574
00:35:57,700 --> 00:35:51,430
accelerated repeatedly just to make sure

575
00:36:04,360 --> 00:35:57,710
this will be done first next another

576
00:36:07,440 --> 00:36:04,370
question is a dark matter we know ninety

577
00:36:12,360 --> 00:36:07,450
percent of the matter in the universe

578
00:36:16,060 --> 00:36:12,370
cannot be seen because you cannot see

579
00:36:18,820 --> 00:36:16,070
that why you called augment and nobody

580
00:36:22,480 --> 00:36:18,830
know what dark matter is and you cannot

581
00:36:24,480 --> 00:36:22,490
because you cannot see but collision of

582
00:36:28,270 --> 00:36:24,490
dark matter will detect with each other

583
00:36:32,560 --> 00:36:28,280
can produce particles like electrons or

584
00:36:34,930 --> 00:36:32,570
like positrons and so the collision of

585
00:36:37,900 --> 00:36:34,940
dark matter will produce positrons and

586
00:36:41,320 --> 00:36:37,910
electrons but creating of ordinary

587
00:36:44,770 --> 00:36:41,330
cosmic ray will also produce positrons

588
00:36:47,920 --> 00:36:44,780

and electrons and so if you measure the

589
00:36:53,110 --> 00:36:47,930
total pass at home or you like on there

590
00:36:55,450 --> 00:36:53,120
will be the sum of this to the fact it's

591
00:36:57,460 --> 00:36:55,460
the sum of these two means it's more

592
00:37:01,840 --> 00:36:57,470
than the ordinary course a great

593
00:37:05,860 --> 00:37:01,850
condition and this give you he give your

594
00:37:09,390 --> 00:37:05,870
idea that you finally understood who are

595
00:37:14,350 --> 00:37:09,400
the ninety percent of the universe come

596
00:37:17,650 --> 00:37:14,360
mattering the universe come from now

597
00:37:23,800 --> 00:37:17,660
that all the show okay

598
00:37:28,190 --> 00:37:23,810
another the important fitted question is

599
00:37:31,610 --> 00:37:28,200
antimatter if the universe come from a

600
00:37:37,040 --> 00:37:31,620
big band before the Big Bang it is

601
00:37:40,100 --> 00:37:37,050
vacuum nothing exists invention so at

602
00:37:41,720 --> 00:37:40,110
the beginning you have an electron you

603
00:37:44,780 --> 00:37:41,730
must have a possible so the charges

604
00:37:47,420 --> 00:37:44,790
balance so you have matter you must have

605
00:37:49,880 --> 00:37:47,430
antimatter otherwise you will not have

606
00:37:55,910 --> 00:37:49,890
come from a vacuum so now the universe

607
00:38:01,130 --> 00:37:55,920
is 14 billion years old who have all of

608
00:38:04,570 --> 00:38:01,140
us and made out of matter the questions

609
00:38:07,550 --> 00:38:04,580
were the universe made out of antimatter

610
00:38:11,060 --> 00:38:07,560
Wednesday's experiment the reason we

611
00:38:14,290 --> 00:38:11,070
designed with such such a large site

612
00:38:17,930 --> 00:38:14,300
with so many layers of repetitive

613
00:38:21,850 --> 00:38:17,940

precision detector is to search for the

614
00:38:25,330 --> 00:38:21,860
existence of antimatter to the aid of

615
00:38:29,300 --> 00:38:25,340
observable universe for anti healing

616
00:38:35,180 --> 00:38:29,310
anti carbon and we can read distinguish

617
00:38:39,370 --> 00:38:35,190
this particle from billings of ordinary

618
00:38:42,590 --> 00:38:39,380
particles like carbon or helium in space

619
00:38:47,660 --> 00:38:42,600
if you think about it this is not a

620
00:38:50,990 --> 00:38:47,670
trivial gal in a city of houston do

621
00:38:55,550 --> 00:38:51,000
during the rainy season you have about

622
00:38:58,730 --> 00:38:55,560
10 billion green blobs per second if you

623
00:39:04,580 --> 00:38:58,740
want to find one that's of different

624
00:39:07,010 --> 00:39:04,590
color somewhat difficult that's why the

625
00:39:12,330 --> 00:39:07,020
disk illustrates the preceding this

626
00:39:17,530 --> 00:39:12,340
detector is going to achieve next one

627
00:39:21,820 --> 00:39:17,540
another interesting new idea this was a

628
00:39:28,720 --> 00:39:21,830
first proposed by edge Wheaton and gags

629
00:39:35,050 --> 00:39:28,730
and lives of jail is pursuing this new

630
00:39:44,530 --> 00:39:35,060
material up in space now you must have

631
00:39:47,740 --> 00:39:44,540
heard all day metal in accelerator if

632
00:39:50,340 --> 00:39:47,750
you look to the accelerator you will see

633
00:39:53,050 --> 00:39:50,350
the smallest particles called quarks

634
00:39:56,890 --> 00:39:53,060
there are six different kind of quarks

635
00:40:02,410 --> 00:39:56,900
one call you on Cordy another call s

636
00:40:06,910 --> 00:40:02,420
another call be another korte so we know

637
00:40:12,550 --> 00:40:06,920
such quarks exists but it is very very

638
00:40:16,150 --> 00:40:12,560

strange all the material on earth I made

639
00:40:18,250 --> 00:40:16,160
out of first to you and deep so we know

640
00:40:21,220 --> 00:40:18,260
in the accelerator or six type exists

641
00:40:24,900 --> 00:40:21,230
but on earth you only see the first tool

642
00:40:27,310 --> 00:40:24,910
so that simple question you wanna ask is

643
00:40:32,500 --> 00:40:27,320
horoscope material made out of three

644
00:40:34,690 --> 00:40:32,510
type of quarks you D&S may be a simple

645
00:40:39,760 --> 00:40:34,700
question but a very very important

646
00:40:47,560 --> 00:40:39,770
question see knew where is a new

647
00:40:52,090 --> 00:40:47,570
material next so the issue are just a

648
00:40:54,610 --> 00:40:52,100
share with you of antimatter in the

649
00:40:58,060 --> 00:40:54,620
universe and already of dark matter

650
00:41:02,920 --> 00:40:58,070
really fun probes the foundations of

651
00:41:08,100 --> 00:41:02,930
modern physics but to my collaborators

652
00:41:11,950 --> 00:41:08,110
my collaborators and I the most exciting

653
00:41:16,060 --> 00:41:11,960
objective of a mess is to probe the

654
00:41:20,260 --> 00:41:16,070
unknown to search for phenomena we kept

655
00:41:27,180 --> 00:41:20,270
this in nature but yet we have not the

656
00:41:27,190 --> 00:41:35,550
so let me explain to you what I'm saying

657
00:41:47,710 --> 00:41:45,130
while received my PhD degree in 1962 the

658
00:41:51,400 --> 00:41:47,720
highest energy accelerator in the world

659
00:41:57,220 --> 00:41:51,410
the people decided sense to do frontier

660
00:42:01,380 --> 00:41:57,230
science wise I in geneva at cern another

661
00:42:05,740 --> 00:42:01,390
is a Brookhaven in Long Island there

662
00:42:08,440 --> 00:42:05,750
already no purpose of this detectors of

663
00:42:13,200 --> 00:42:08,450

this accelerator was to study nuclear

664
00:42:16,090 --> 00:42:13,210
force the mini theory how to how to

665
00:42:20,260 --> 00:42:16,100
understand nuclear force by the

666
00:42:22,870 --> 00:42:20,270
discovery i discern assumption kanuto

667
00:42:26,760 --> 00:42:22,880
current which he winkle leads to the

668
00:42:32,700 --> 00:42:26,770
unification of weak forces and

669
00:42:36,340 --> 00:42:32,710
electromagnetic forces I broke heaven

670
00:42:39,550 --> 00:42:36,350
there were three major discoveries why

671
00:42:42,310 --> 00:42:39,560
is new form of matter the existence of

672
00:42:45,880 --> 00:42:42,320
new form of matter which is the one I

673
00:42:48,870 --> 00:42:45,890
received a Nobel Prize another is the

674
00:42:51,780 --> 00:42:48,880
breakdown of basic symmetry principle

675
00:43:00,880 --> 00:42:51,790
just work done by Professor crony

676
00:43:12,700 --> 00:43:00,890
another why is this if I couldn't see

677
00:43:17,260 --> 00:43:12,710
this one yes hold it is yes how could I

678
00:43:21,460 --> 00:43:17,270
forgot that is a neutrinos actually have

679
00:43:26,250 --> 00:43:21,470
to kind neutrinos chargeless particle

680
00:43:31,480 --> 00:43:26,260
first proposed in the 1930s as massless

681
00:43:33,190 --> 00:43:31,490
only one kind but it is the experiments

682
00:43:34,530 --> 00:43:33,200
is no there's not only one can dare to

683
00:43:39,640 --> 00:43:34,540
cut

684
00:43:42,580 --> 00:43:39,650
in 1970s the United States build a very

685
00:43:45,550 --> 00:43:42,590
large elaborate laboratory in for a new

686
00:43:47,560 --> 00:43:45,560
Chicago confirming laboratory and the

687
00:43:49,870 --> 00:43:47,570
purpose was to study neutrino physics

688
00:43:53,680 --> 00:43:49,880

because brooke haven't found their too

689
00:44:00,520 --> 00:43:53,690
high but what was discovered was the

690
00:44:06,060 --> 00:44:00,530
fifth chord and the 64 esta at same time

691
00:44:09,610 --> 00:44:06,070
a slag Stanford Linear Accelerator debut

692
00:44:12,910 --> 00:44:09,620
electron-positron Collider the original

693
00:44:16,150 --> 00:44:12,920
purpose were to study property of

694
00:44:20,110 --> 00:44:16,160
electricity and he really made mainly

695
00:44:23,650 --> 00:44:20,120
important discoveries and including the

696
00:44:29,320 --> 00:44:23,660
fourth family of corn the third type of

697
00:44:35,010 --> 00:44:29,330
electrons and also find inside the

698
00:44:41,670 --> 00:44:35,020
proton they are pop there are many cores

699
00:44:45,790 --> 00:44:41,680
then in 1980s the largest accelerator

700
00:44:49,390 --> 00:44:45,800
for electron pulses on collision was in

701
00:44:52,060 --> 00:44:49,400
Hamburg Corp at law the original purpose

702
00:44:55,570 --> 00:44:52,070
was to look for the sixth type of pork

703
00:44:58,450 --> 00:44:55,580
what was discovered was not a sixth type

704
00:45:04,030 --> 00:44:58,460
of work was something called glue which

705
00:45:07,150 --> 00:45:04,040
bound the quarks together so when you

706
00:45:11,730 --> 00:45:07,160
look all these accelerators your build

707
00:45:15,640 --> 00:45:11,740
accelerator you ask the best businesses

708
00:45:18,060 --> 00:45:15,650
to tear the government while you're

709
00:45:21,280 --> 00:45:18,070
going to study but when you make a

710
00:45:24,490 --> 00:45:21,290
proceeding instrumentation you do the

711
00:45:27,880 --> 00:45:24,500
experiment you're discovering you will

712
00:45:29,800 --> 00:45:27,890
fundamental breakthrough always had

713
00:45:32,170 --> 00:45:29,810

nothing to do with their original

714
00:45:35,350 --> 00:45:32,180
purpose they argue is very simple

715
00:45:38,800 --> 00:45:35,360
because they already know purpose is

716
00:45:40,900 --> 00:45:38,810
based on existing knowledge discovery is

717
00:45:43,780 --> 00:45:40,910
to advance the existing on its own it's

718
00:45:47,620 --> 00:45:43,790
difficult to predict

719
00:45:50,680 --> 00:45:47,630
and so I think the real purpose of AMS

720
00:45:56,140 --> 00:45:50,690
is utilized the tremendous scientific

721
00:46:00,190 --> 00:45:56,150
potential of space station and to probe

722
00:46:05,320 --> 00:46:00,200
the unknown so I finished my little

723
00:46:07,330 --> 00:46:05,330
explanation okay next we're going to

724
00:46:08,620 --> 00:46:07,340
open up the floor for questions we'll

725
00:46:10,570 --> 00:46:08,630
start here in the room and if you can

726
00:46:11,950 --> 00:46:10,580
please be sure and state your name and

727
00:46:14,680 --> 00:46:11,960
organization before you say your

728
00:46:17,070 --> 00:46:14,690
question oh thank you Mark kuro for

729
00:46:22,960 --> 00:46:17,080
aviation week can you sort of explain

730
00:46:24,880 --> 00:46:22,970
the the process of activating and how

731
00:46:29,950 --> 00:46:24,890
long it takes to calibrate or whatever

732
00:46:33,400 --> 00:46:29,960
you have to do to start studies and how

733
00:46:35,950 --> 00:46:33,410
is the AMS controlled from the ground

734
00:46:40,710 --> 00:46:35,960
where does a science data go and who

735
00:46:42,520 --> 00:46:40,720
manages that for distribution Thanks so

736
00:46:47,710 --> 00:46:42,530
I'll cover some of the operations

737
00:46:49,510 --> 00:46:47,720
portions once-once whats AMS is put onto

738
00:46:52,450 --> 00:46:49,520

the space station the data comes down

739
00:46:54,820 --> 00:46:52,460
through the space station standard data

740
00:46:58,270 --> 00:46:54,830
paths eventually makes its way back to

741
00:47:00,010 --> 00:46:58,280
Mission Control here in houston we have

742
00:47:02,140 --> 00:47:00,020
a payload operation control center

743
00:47:04,120 --> 00:47:02,150
already set up at the pay at Mission

744
00:47:07,420 --> 00:47:04,130
Control here in Houston we will operate

745
00:47:09,460 --> 00:47:07,430
the payload from that POC for the

746
00:47:11,290 --> 00:47:09,470
initial phases of AMS during the shuttle

747
00:47:15,580 --> 00:47:11,300
mission and for the initial operations

748
00:47:17,680 --> 00:47:15,590
on the International Space Station we we

749
00:47:19,480 --> 00:47:17,690
operate the payload from there we turn

750
00:47:23,020 --> 00:47:19,490
on different detectors change power

751
00:47:24,670 --> 00:47:23,030
levels to different instruments etc make

752
00:47:26,980 --> 00:47:24,680
sure that the thermal balance is in is

753
00:47:29,080 --> 00:47:26,990
in check once the science data comes

754
00:47:31,900 --> 00:47:29,090
down it's checked to make sure that it

755
00:47:33,310 --> 00:47:31,910
matches with what we saw on orbit we

756
00:47:35,890 --> 00:47:33,320
then send that data out to various

757
00:47:38,590 --> 00:47:35,900
science centers around the world once

758
00:47:39,850 --> 00:47:38,600
completely operational that up that

759
00:47:43,600 --> 00:47:39,860
payload operation control center will

760
00:47:45,820 --> 00:47:43,610
move to CERN in Geneva and for the long

761
00:47:48,040 --> 00:47:45,830
duration operations of AMS it will be

762
00:47:53,140 --> 00:47:48,050
done out of Geneva mainly by the MS

763
00:47:58,460 --> 00:47:56,480

yes I wondered I guess there's a is

764
00:48:02,420 --> 00:47:58,470
there a commissioning period when you're

765
00:48:05,930 --> 00:48:02,430
sort of tuning is it worth or does it

766
00:48:09,320 --> 00:48:05,940
does it line up and and and work right

767
00:48:11,450 --> 00:48:09,330
away with good data so it's we have a

768
00:48:14,510 --> 00:48:11,460
several hour period where we're turning

769
00:48:16,220 --> 00:48:14,520
on the power systems but once that once

770
00:48:18,770 --> 00:48:16,230
it's turned on the instruments are

771
00:48:21,230 --> 00:48:18,780
operational we're immediately gathering

772
00:48:22,670 --> 00:48:21,240
data now I'll leave it up to Professor

773
00:48:24,500 --> 00:48:22,680
King to decide how long it takes before

774
00:48:30,590 --> 00:48:24,510
it comes back to you with scientific

775
00:48:34,190 --> 00:48:30,600
discoveries from that data but I would

776
00:48:36,800 --> 00:48:34,200
imagine working one or two hours we

777
00:48:40,849 --> 00:48:36,810
should begin to receive data by the way

778
00:48:52,460 --> 00:48:40,859
we have checked the detector over over

779
00:48:55,640 --> 00:48:52,470
over again in fact the we put the

780
00:48:58,640 --> 00:48:55,650
detector versus somebody detector

781
00:49:01,340 --> 00:48:58,650
detector has a three hundred thousand

782
00:49:04,400 --> 00:49:01,350
channels so they love enormous amount of

783
00:49:06,620 --> 00:49:04,410
cables hundreds of thousands of cable so

784
00:49:09,859 --> 00:49:06,630
the first time we had somebody detector

785
00:49:12,020 --> 00:49:09,869
was end of 2007 and we cut the cable to

786
00:49:15,740 --> 00:49:12,030
the lens took six months to put the

787
00:49:20,330 --> 00:49:15,750
detectors together and then we take it

788
00:49:24,050 --> 00:49:20,340

apart took one month's second time we

789
00:49:26,540 --> 00:49:24,060
installed it take one months and then we

790
00:49:29,480 --> 00:49:26,550
took it apart I installed again we took

791
00:49:32,900 --> 00:49:29,490
it apart installed total two or three

792
00:49:36,940 --> 00:49:32,910
times mainly just to make sure we are

793
00:49:42,770 --> 00:49:36,950
solely familiar with audit components

794
00:49:45,170 --> 00:49:42,780
and we also ported it Hector each each

795
00:49:48,500 --> 00:49:45,180
of the detector has gone to accelerate a

796
00:49:50,810 --> 00:49:48,510
test and then together we went to the

797
00:49:52,940 --> 00:49:50,820
accelerated heads again to make sure

798
00:49:57,590 --> 00:49:52,950
this detector doesn't affect the next

799
00:50:00,800 --> 00:49:57,600
one and this was in was in Geneva twice

800
00:50:04,490 --> 00:50:00,810
once in February last year and second

801
00:50:05,450 --> 00:50:04,500
time in august and in kennedy space

802
00:50:10,970 --> 00:50:05,460
center

803
00:50:15,109 --> 00:50:10,980
we did also test and then final last

804
00:50:19,880 --> 00:50:15,119
test will be a few days before before

805
00:50:24,380 --> 00:50:19,890
liftoff with the dome will do one more

806
00:50:26,960 --> 00:50:24,390
test so on the space station it should

807
00:50:30,520 --> 00:50:26,970
come back the data shall come back very

808
00:50:33,710 --> 00:50:30,530
quickly within hours less than an hour

809
00:50:38,390 --> 00:50:33,720
this has happened exactly the same thing

810
00:50:40,730 --> 00:50:38,400
what do we did in the first line in

811
00:50:42,079 --> 00:50:40,740
addition to the operations that we do on

812
00:50:44,510 --> 00:50:42,089
the International Space Station when we

813
00:50:46,339 --> 00:50:44,520

launched within about two hours after

814
00:50:49,010 --> 00:50:46,349
launch we will turn on AMS in the

815
00:50:53,540 --> 00:50:49,020
payload Bay the orbiter will ensure that

816
00:50:55,790 --> 00:50:53,550
it survived the ride and and check out

817
00:50:57,170 --> 00:50:55,800
the basically thermally conditioned the

818
00:50:58,880 --> 00:50:57,180
payload to ensure that when we're ready

819
00:51:01,430 --> 00:50:58,890
to do that arm to arm transfer that

820
00:51:03,440 --> 00:51:01,440
we're warm enough that we can do that

821
00:51:09,589 --> 00:51:03,450
for there's a stage where we would have

822
00:51:11,540 --> 00:51:09,599
zero power on to the payload bill are

823
00:51:13,070 --> 00:51:11,550
with CBS with a couple of questions the

824
00:51:14,890 --> 00:51:13,080
data that comes down you don't store it

825
00:51:18,859 --> 00:51:14,900
on board right it's a continuous

826
00:51:20,900 --> 00:51:18,869
downlink is there a measure of how much

827
00:51:29,109 --> 00:51:20,910
data comes down in a given 24 hour

828
00:51:32,839 --> 00:51:29,119
period the day ha come down continuously

829
00:51:37,609 --> 00:51:32,849
occasionally cursor interruption of the

830
00:51:41,540 --> 00:51:37,619
downlink so we have a computer on board

831
00:51:44,120 --> 00:51:41,550
and the old also a computer in the

832
00:51:47,510 --> 00:51:44,130
detector itself which has a massive

833
00:51:51,230 --> 00:51:47,520
storage and so in principle can store

834
00:51:54,920 --> 00:51:51,240
for quite a few months before we can

835
00:51:56,900 --> 00:51:54,930
send them down for you you you never

836
00:51:59,630 --> 00:51:56,910
know if the space stations there for 20

837
00:52:00,920 --> 00:51:59,640
years and you don't know for the next is

838
00:52:03,710 --> 00:52:00,930

there will be a few months time

839
00:52:05,390 --> 00:52:03,720
something may happen so we dis have been

840
00:52:10,579 --> 00:52:05,400
taken care of in fact the computer

841
00:52:15,600 --> 00:52:10,589
stories was delivered by 133 and when

842
00:52:22,050 --> 00:52:15,610
the data comes down goes to Geneva

843
00:52:26,280 --> 00:52:22,060
and we have a rather good park and a

844
00:52:29,460 --> 00:52:26,290
sock and with the data will be analyzed

845
00:52:32,390 --> 00:52:29,470
the center it was into our in Germany to

846
00:52:37,320 --> 00:52:32,400
Italy to Switzerland to all the places

847
00:52:41,520 --> 00:52:37,330
to analyze the data to get to give you

848
00:52:43,740 --> 00:52:41,530
an idea of the amount of data currently

849
00:52:46,770 --> 00:52:43,750
with AMS run it well last week when AMS

850
00:52:51,720 --> 00:52:46,780
was running in the SS PF at KSC we were

851
00:52:53,370 --> 00:52:51,730
seeing 400 hits per second of particles

852
00:52:56,100 --> 00:52:53,380
when we get to the International Space

853
00:52:59,430 --> 00:52:56,110
Station we expect to see 25,000 hits per

854
00:53:02,430 --> 00:52:59,440
second we're gathering data at seven

855
00:53:04,650 --> 00:53:02,440
gigabits per second we can't send that

856
00:53:07,410 --> 00:53:04,660
huge amount of data down through the

857
00:53:09,720 --> 00:53:07,420
space station data systems is just too

858
00:53:12,750 --> 00:53:09,730
much so the onboard computers actually

859
00:53:14,460 --> 00:53:12,760
go through a process of condensing that

860
00:53:16,620 --> 00:53:14,470
data down to just the data that we're

861
00:53:19,560 --> 00:53:16,630
truly interested in compressing it as

862
00:53:22,320 --> 00:53:19,570
much as possible we send down data on

863
00:53:24,390 --> 00:53:22,330

average at about six megabits per second

864
00:53:26,730 --> 00:53:24,400
constantly for the entire time that AMS

865
00:53:28,740 --> 00:53:26,740
is on the computers that Professor tank

866
00:53:31,350 --> 00:53:28,750
spoke of can store up data and we can

867
00:53:34,680 --> 00:53:31,360
burst it down at much higher rate that

868
00:53:36,630 --> 00:53:34,690
allows us to do it at less peak times of

869
00:53:41,100 --> 00:53:36,640
data traffic coming back and forth from

870
00:53:44,010 --> 00:53:41,110
station an enormous amount of time on

871
00:53:45,210 --> 00:53:44,020
this project from birth to getting to

872
00:53:49,080 --> 00:53:45,220
this point where you're ready to launch

873
00:53:50,640 --> 00:53:49,090
I know scientists don't get terribly

874
00:53:51,660 --> 00:53:50,650
emotional about the hardware i guess but

875
00:53:53,730 --> 00:53:51,670
this is quite a moment for you

876
00:53:55,380 --> 00:53:53,740
personally as well as the team but what

877
00:53:57,150 --> 00:53:55,390
are your thoughts on a personal level

878
00:53:59,550 --> 00:53:57,160
that you finally gotten to this point

879
00:54:10,290 --> 00:53:59,560
where this payload is finally going to

880
00:54:16,410 --> 00:54:10,300
fly if you ask me what i do every day my

881
00:54:20,340 --> 00:54:16,420
biggest worry my biggest concern is to

882
00:54:22,440 --> 00:54:20,350
make sure the instrument is correct but

883
00:54:24,630 --> 00:54:22,450
this is different from you to experiment

884
00:54:27,790 --> 00:54:24,640
on the ground if something's wrong you

885
00:54:35,210 --> 00:54:27,800
can send a graduate student to

886
00:54:39,079 --> 00:54:35,220
and so high indeed spend enormous amount

887
00:54:40,940 --> 00:54:39,089
of time thinking what could go wrong the

888
00:54:43,640 --> 00:54:40,950

fact well I just mentioned we took it

889
00:54:47,380 --> 00:54:43,650
apart and reassemble bong the purpose of

890
00:54:51,859 --> 00:54:47,390
his days for the electronics will have a

891
00:54:54,710 --> 00:54:51,869
4-port redundancy and just make sure

892
00:54:59,270 --> 00:54:54,720
once bad you will switch automatically

893
00:55:02,210 --> 00:54:59,280
tan X 1 2 next one to the next one which

894
00:55:06,859 --> 00:55:02,220
the implication of this experiment is

895
00:55:10,820 --> 00:55:06,869
the following given the difficulty we

896
00:55:12,890 --> 00:55:10,830
have to build this experiment given the

897
00:55:17,800 --> 00:55:12,900
enormous amount of difficulty have an

898
00:55:22,190 --> 00:55:17,810
international collaboration and I think

899
00:55:25,329 --> 00:55:22,200
in the next 10 to 20 years nobody will

900
00:55:29,720 --> 00:55:25,339
be foolish enough to repeat this again

901
00:55:32,900 --> 00:55:29,730
and therefore it is very very important

902
00:55:34,910 --> 00:55:32,910
we do it correctly a lot of wise you

903
00:55:38,329 --> 00:55:34,920
certainly is going to miss Lee the

904
00:55:41,060 --> 00:55:38,339
direction of science I think all first

905
00:55:43,640 --> 00:55:41,070
obligation but only obligation is to

906
00:55:49,400 --> 00:55:43,650
make sure the instrument is correct what

907
00:55:55,910 --> 00:55:52,480
hi Robert Pearlman with collectspace.com

908
00:55:57,290 --> 00:55:55,920
you mentioned that it keeps that you are

909
00:55:59,870 --> 00:55:57,300
concerned that the instrument is correct

910
00:56:01,580 --> 00:55:59,880
and that it works in the unthinkable

911
00:56:04,550 --> 00:56:01,590
situation that it gets attached to the

912
00:56:08,330 --> 00:56:04,560
ISS and something doesn't work what's

913
00:56:10,850 --> 00:56:08,340

the recourse is there can do you barring

914
00:56:13,970 --> 00:56:10,860
graduate students do you send these hen

915
00:56:18,380 --> 00:56:13,980
spacewalkers out to to work on is it

916
00:56:21,050 --> 00:56:18,390
serves the melon space no you only have

917
00:56:27,380 --> 00:56:21,060
one person to blame who is sitting in

918
00:56:29,000 --> 00:56:27,390
front of you there's no recourse who

919
00:56:33,710 --> 00:56:29,010
have this is why we have motive

920
00:56:39,100 --> 00:56:33,720
redundancy motivate and Motor City

921
00:56:45,110 --> 00:56:42,490
that is the only thing we can do a

922
00:56:48,710 --> 00:56:45,120
permanent magnet has the good fortune

923
00:56:51,200 --> 00:56:48,720
you can ask switched off so the Magnum

924
00:56:54,380 --> 00:56:51,210
will work and translation radiation

925
00:56:57,920 --> 00:56:54,390
detector was tested repeatedly every

926
00:57:00,440 --> 00:56:57,930
detector were two down individual space

927
00:57:02,480 --> 00:57:00,450
qualification test and the whole

928
00:57:08,200 --> 00:57:02,490
detector together the space

929
00:57:12,890 --> 00:57:08,210
qualification tests so I suspect unless

930
00:57:16,640 --> 00:57:12,900
somebody drop it then there's a nothing

931
00:57:21,080 --> 00:57:16,650
we can do probably the chance of not

932
00:57:24,110 --> 00:57:21,090
working politics quite small they follow

933
00:57:26,000 --> 00:57:24,120
up with that when you have a detector

934
00:57:28,330 --> 00:57:26,010
that has 300,000 data channels that

935
00:57:32,600 --> 00:57:28,340
means you have 300,000 wires somewhere

936
00:57:34,160 --> 00:57:32,610
right we looked early on it should we do

937
00:57:36,740 --> 00:57:34,170
something modular like we did with

938
00:57:38,090 --> 00:57:36,750

Hubble or with other missions and the

939
00:57:39,620 --> 00:57:38,100
complexity within the science

940
00:57:41,600 --> 00:57:39,630
experiments was just too difficult for

941
00:57:43,790 --> 00:57:41,610
us to do that however what we have done

942
00:57:45,800 --> 00:57:43,800
is we do have the capability for the

943
00:57:47,810 --> 00:57:45,810
non-scientific portions essentially a

944
00:57:49,010 --> 00:57:47,820
data or power systems coming from the

945
00:57:51,410 --> 00:57:49,020
space station we actually have the

946
00:57:53,120 --> 00:57:51,420
capability to go out EBA and change some

947
00:57:54,500 --> 00:57:53,130
of those things out if we're if you lose

948
00:57:56,360 --> 00:57:54,510
power out of one line we can go out and

949
00:57:58,520 --> 00:57:56,370
switch that around if we lose data from

950
00:58:00,800 --> 00:57:58,530
one line we can go switch that but

951
00:58:01,799 --> 00:58:00,810
barring those minor adjustments that we

952
00:58:03,870 --> 00:58:01,809
can make

953
00:58:08,579 --> 00:58:03,880
the experiment detector is just too

954
00:58:11,819 --> 00:58:08,589
complex to make it modular and just as a

955
00:58:13,920 --> 00:58:11,829
quick follow-up is there an advantage to

956
00:58:16,019 --> 00:58:13,930
where it's being placed on the station

957
00:58:18,719 --> 00:58:16,029
was there was there a more advantageous

958
00:58:20,699 --> 00:58:18,729
place to to attach it to station or was

959
00:58:23,759 --> 00:58:20,709
it just an open spot where it could go

960
00:58:25,829 --> 00:58:23,769
we went through extensive Studies on

961
00:58:30,420 --> 00:58:25,839
exactly where we should put AMS AMS is

962
00:58:32,279 --> 00:58:30,430
sitting at a site at one of the of the

963
00:58:33,630 --> 00:58:32,289

six or seven attached sites there's one

964
00:58:36,329 --> 00:58:33,640
on the mobile transporter as well but

965
00:58:39,179 --> 00:58:36,339
one of the six fixed payload attached

966
00:58:41,069 --> 00:58:39,189
sites the furthest away from the solar

967
00:58:45,239 --> 00:58:41,079
arrays and we actually tilted it 12

968
00:58:47,189 --> 00:58:45,249
degrees what 12 was at a magic number

969
00:58:48,630 --> 00:58:47,199
but we tilted it a certain amount of

970
00:58:50,279 --> 00:58:48,640
degrees away so that we could actually

971
00:58:51,749 --> 00:58:50,289
get the field of view away from the

972
00:58:54,150 --> 00:58:51,759
solar array so that we would see those

973
00:58:58,109 --> 00:58:54,160
in our field of view as few times as

974
00:59:00,959 --> 00:58:58,119
possible so we are now sitting in a spot

975
00:59:02,579 --> 00:59:00,969
where we cannot move it easily without

976
00:59:04,650 --> 00:59:02,589
without adjusting the rest of the the

977
00:59:05,999 --> 00:59:04,660
hardware that's own space station we

978
00:59:08,370 --> 00:59:06,009
obviously have to be pointed away from

979
00:59:11,729 --> 00:59:08,380
the earth so we can only take one of the

980
00:59:13,499 --> 00:59:11,739
three spots on top and this this was by

981
00:59:19,259 --> 00:59:13,509
far the best site for AMS on Space

982
00:59:20,999 --> 00:59:19,269
Station genius and Sarah ABC News is it

983
00:59:23,429 --> 00:59:21,009
possible to have a significant

984
00:59:25,289 --> 00:59:23,439
scientific discovery before endeavour

985
00:59:28,880 --> 00:59:25,299
lands I mean how long would it take to

986
00:59:36,120 --> 00:59:28,890
process this and figure out what's what

987
00:59:40,380 --> 00:59:36,130
it is even if you have something new you

988
00:59:46,109 --> 00:59:40,390

can never predict the future I think we

989
00:59:50,599 --> 00:59:46,119
want to check it a better care for it we

990
00:59:53,489 --> 00:59:50,609
want to make sure everything's correct I

991
00:59:55,410 --> 00:59:53,499
think the chance for make an

992
00:59:59,189 --> 00:59:55,420
announcement just for the announcement

993
01:00:01,620 --> 00:59:59,199
sake problem is not what we should do we

994
01:00:04,620 --> 01:00:01,630
want to do it very systematically very

995
01:00:09,269 --> 01:00:04,630
carefully to do we are going to have to

996
01:00:11,740 --> 01:00:09,279
analysis teams to independent analysis

997
01:00:22,470 --> 01:00:11,750
teams analyze the same thing

998
01:00:29,170 --> 01:00:25,930
and its key with Harvard journalism as a

999
01:00:32,140 --> 01:00:29,180
Nobel laureate can you speak again about

1000
01:00:34,330 --> 01:00:32,150
your experience with dances support wise

1001
01:00:36,580 --> 01:00:34,340
and what do you more importantly say to

1002
01:00:39,130 --> 01:00:36,590
other scientists in the States and

1003
01:00:41,410 --> 01:00:39,140
around the world about accessing the

1004
01:00:45,160 --> 01:00:41,420
International Space Station as a science

1005
01:00:48,040 --> 01:00:45,170
research laboratory please repeat your

1006
01:00:50,650 --> 01:00:48,050
question because your second part of the

1007
01:00:53,200 --> 01:00:50,660
first part of this slightly disconnected

1008
01:00:55,600 --> 01:00:53,210
right but your experience with NASA you

1009
01:00:57,490 --> 01:00:55,610
describe is very good in strong support

1010
01:00:59,620 --> 01:00:57,500
so what do you say to other scientists

1011
01:01:02,170 --> 01:00:59,630
about accessing the International Space

1012
01:01:07,000 --> 01:01:02,180
Station as a science research laboratory

1013
01:01:19,000 --> 01:01:07,010

through 2020 I would imagine if a good

1014
01:01:21,880 --> 01:01:19,010
idea and you will find a way a good idea

1015
01:01:26,260 --> 01:01:21,890
means the following okay you hope you

1016
01:01:31,390 --> 01:01:26,270
have an idea you write a proposal to the

1017
01:01:36,040 --> 01:01:31,400
agency and you ask for review and the

1018
01:01:41,110 --> 01:01:36,050
reviewer or examine your physics or

1019
01:01:46,240 --> 01:01:41,120
science ideas also a very important

1020
01:01:49,690 --> 01:01:46,250
thing is what have you done before have

1021
01:01:52,350 --> 01:01:49,700
you ever made a mistake as every one of

1022
01:01:55,630 --> 01:01:52,360
your experiment has contribute something

1023
01:02:00,700 --> 01:01:55,640
so called track record and these are

1024
01:02:04,450 --> 01:02:00,710
also a good kamiki a good peer review

1025
01:02:08,080 --> 01:02:04,460
should cover that because just to to see

1026
01:02:10,360 --> 01:02:08,090
a proposal you can write whatever you

1027
01:02:14,290 --> 01:02:10,370
want and then is difficult to judge

1028
01:02:16,990 --> 01:02:14,300
since I would imagine if there are good

1029
01:02:20,440 --> 01:02:17,000
ideas the space station is really it

1030
01:02:24,180 --> 01:02:20,450
really useful thing because of size you

1031
01:02:27,880 --> 01:02:24,190
can support heavy way and provide power

1032
01:02:37,030 --> 01:02:27,890
really it's a very useful him for

1033
01:02:41,360 --> 01:02:39,310
Eric burger with the Houston Chronicle

1034
01:02:43,400 --> 01:02:41,370
following that up and then I'll have an

1035
01:02:45,800 --> 01:02:43,410
additional question is that the primary

1036
01:02:49,400 --> 01:02:45,810
reason why the AMS had to be on the

1037
01:02:54,290 --> 01:02:49,410
station was its power needs power on the

1038
01:02:57,500 --> 01:02:54,300

wait if you go on satellite right you're

1039
01:03:00,220 --> 01:02:57,510
going to have to build you're going to

1040
01:03:03,320 --> 01:03:00,230
have to be r you have to find a rocket

1041
01:03:08,510 --> 01:03:03,330
carries seven and half tons of low and

1042
01:03:11,990 --> 01:03:08,520
you have to build a solar power to

1043
01:03:14,900 --> 01:03:12,000
provide 2500 watt you have to provide

1044
01:03:19,340 --> 01:03:14,910
data transmission and this week in no

1045
01:03:24,200 --> 01:03:19,350
muscling costly in fact this question

1046
01:03:27,920 --> 01:03:24,210
was asked of me a year ago when fittest

1047
01:03:33,170 --> 01:03:27,930
is called steep Hawking shut up Richard

1048
01:03:35,900 --> 01:03:33,180
me spend a hot afternoon with me after

1049
01:03:41,630 --> 01:03:35,910
my little explanation he only had one

1050
01:03:49,030 --> 01:03:41,640
question I was the same question well

1051
01:03:53,360 --> 01:03:51,770
the second question I would ask is is

1052
01:03:56,540 --> 01:03:53,370
this has been a long and winding road

1053
01:04:00,050 --> 01:03:56,550
for you 17 years and you're essentially

1054
01:04:03,740 --> 01:04:00,060
trying to sell bean counters not at NASA

1055
01:04:04,700 --> 01:04:03,750
and Congress on something that we think

1056
01:04:07,580 --> 01:04:04,710
we're going to find something really

1057
01:04:09,260 --> 01:04:07,590
exciting but we don't know what it is so

1058
01:04:13,090 --> 01:04:09,270
maybe talk about sort of the challenge

1059
01:04:15,890 --> 01:04:13,100
of selling basic science in a

1060
01:04:21,770 --> 01:04:15,900
results-driven what can you do for me

1061
01:04:24,290 --> 01:04:21,780
now world of politics and funding I this

1062
01:04:28,070 --> 01:04:24,300
symbol of question is slightly different

1063
01:04:33,100 --> 01:04:28,080

former a different form it's asked of me

1064
01:04:39,320 --> 01:04:36,740
what it what wife the physicist it's a

1065
01:04:50,930 --> 01:04:44,000
to try to find something you and I

1066
01:04:55,760 --> 01:04:50,940
personally for me I never had any

1067
01:04:58,160 --> 01:04:55,770
financial problems people look at what

1068
01:05:00,320 --> 01:04:58,170
I've done before what my collaborators

1069
01:05:03,470 --> 01:05:00,330
has done before and people were

1070
01:05:06,320 --> 01:05:03,480
supporters you ask a very important

1071
01:05:12,370 --> 01:05:06,330
question why there's such thing

1072
01:05:18,950 --> 01:05:12,380
countries go through such a torturous

1073
01:05:22,040 --> 01:05:18,960
road to reach today by or in this 13

1074
01:05:25,940 --> 01:05:22,050
years there's a a period of time we were

1075
01:05:28,850 --> 01:05:25,950
not even on the manifest invited you

1076
01:05:31,970 --> 01:05:28,860
german physicist the italian physicist

1077
01:05:35,260 --> 01:05:31,980
and why the united states department of

1078
01:05:38,630 --> 01:05:35,270
energy why am I que continúa supporters

1079
01:05:43,670 --> 01:05:38,640
it's because they believe such a

1080
01:05:49,670 --> 01:05:43,680
important science must be done so I

1081
01:05:53,720 --> 01:05:49,680
don't have any legal authority over any

1082
01:05:56,150 --> 01:05:53,730
funding agencies people work with work

1083
01:06:01,060 --> 01:05:56,160
together because they are curious they

1084
01:06:05,150 --> 01:06:01,070
want to find what the dark matter is

1085
01:06:12,890 --> 01:06:05,160
whether there's antimatter long and the

1086
01:06:14,900 --> 01:06:12,900
question you asked what is good for what

1087
01:06:21,980 --> 01:06:14,910
you can use it for you spend so much

1088
01:06:26,000 --> 01:06:21,990

ever a hundred years ago on x-ray orange

1089
01:06:28,540 --> 01:06:26,010
electron or first discover and then what

1090
01:06:34,630 --> 01:06:28,550
time are just pure scientific research

1091
01:06:43,730 --> 01:06:39,050
1930s the so-called useless science is

1092
01:06:48,440 --> 01:06:43,740
quantum mechanics and atomic physics now

1093
01:06:50,330 --> 01:06:48,450
is useful for your cell phone for your

1094
01:06:57,650 --> 01:06:50,340
laser for all the transmission

1095
01:07:02,780 --> 01:06:57,660
for for your for the 1800 30s and 40s we

1096
01:07:07,670 --> 01:07:02,790
study the Sun and then now now is used

1097
01:07:14,570 --> 01:07:07,680
for many things study also planet now

1098
01:07:18,130 --> 01:07:14,580
used for GPS so from the observation of

1099
01:07:21,500 --> 01:07:18,140
a new phenomena to the discovery

1100
01:07:25,190 --> 01:07:21,510
normally as a period maybe 10 years

1101
01:07:30,350 --> 01:07:25,200
maybe 20 years maybe 30 years whines it

1102
01:07:33,770 --> 01:07:30,360
is used it changes everybody's life but

1103
01:07:37,640 --> 01:07:33,780
during this road of developing new

1104
01:07:40,550 --> 01:07:37,650
technology the developing new signs you

1105
01:07:44,330 --> 01:07:40,560
develop many new technology a very good

1106
01:07:46,670 --> 01:07:44,340
example is world wide web what's

1107
01:07:52,370 --> 01:07:46,680
discovery sir would really affect

1108
01:07:56,420 --> 01:07:52,380
everyone's life I think so that really

1109
01:07:59,630 --> 01:07:56,430
the direct benefit to society but for

1110
01:08:03,410 --> 01:07:59,640
scientists at least for me the main

1111
01:08:06,020 --> 01:08:03,420
reason is curiosity I'm sure my good

1112
01:08:10,130 --> 01:08:06,030
friend professor share which who is here

1113
01:08:16,420 --> 01:08:10,140

share this the same the same passion I

1114
01:08:23,690 --> 01:08:19,820
hi I'm Irene Klotz with Reuters I'm had

1115
01:08:28,190 --> 01:08:23,700
a couple questions for him I've for mr.

1116
01:08:31,550 --> 01:08:28,200
Martin the the power requirements for

1117
01:08:35,480 --> 01:08:31,560
AMS are pretty extensive and I was just

1118
01:08:36,829 --> 01:08:35,490
curious if there's any problems like not

1119
01:08:39,620 --> 01:08:36,839
as severe is what happened with the

1120
01:08:43,790 --> 01:08:39,630
cooling system shut down last year but

1121
01:08:46,700 --> 01:08:43,800
is there some prioritization of what

1122
01:08:49,610 --> 01:08:46,710
experiments get power in case there's

1123
01:08:52,090 --> 01:08:49,620
not full power available yes absolutely

1124
01:08:55,250 --> 01:08:52,100
on Space Station if there's an emergency

1125
01:08:57,290 --> 01:08:55,260
the there there's a set of priorities

1126
01:09:00,079 --> 01:08:57,300
who gets shut off first who gets shut

1127
01:09:02,110 --> 01:09:00,089
off last in those in those systems and

1128
01:09:04,520 --> 01:09:02,120
we work within that system to identify

1129
01:09:06,410 --> 01:09:04,530
AMS is in this configuration right now

1130
01:09:08,750 --> 01:09:06,420
our temperatures are set at this at this

1131
01:09:10,970 --> 01:09:08,760
level we can be shut off for this amount

1132
01:09:14,210 --> 01:09:10,980
of time before we start to harm

1133
01:09:15,470 --> 01:09:14,220
scientific experiment components and

1134
01:09:20,480 --> 01:09:15,480
that so that goes on during a regular

1135
01:09:23,150 --> 01:09:20,490
ongoing basis in operations and yes they

1136
01:09:25,329 --> 01:09:23,160
said that up well ahead of time and we

1137
01:09:27,920 --> 01:09:25,339
know where we are in that net order

1138
01:09:30,050 --> 01:09:27,930

where are you just where loads are

1139
01:09:31,400 --> 01:09:30,060
considered one of the lower order items

1140
01:09:34,550 --> 01:09:31,410
they are some of the first things that

1141
01:09:36,740 --> 01:09:34,560
get shut off AMS because of its large

1142
01:09:39,610 --> 01:09:36,750
power requirement and need to run

1143
01:09:41,810 --> 01:09:39,620
constantly is higher up in that in that

1144
01:09:43,460 --> 01:09:41,820
prioritization but still down with the

1145
01:09:46,400 --> 01:09:43,470
with the payload obviously you don't

1146
01:09:50,240 --> 01:09:46,410
want to shut off the ecosystem first

1147
01:09:51,890 --> 01:09:50,250
before you shut off a paper but but we

1148
01:09:54,050 --> 01:09:51,900
were certainly down in that in that

1149
01:09:58,190 --> 01:09:54,060
range we can also operate at lower

1150
01:10:00,410 --> 01:09:58,200
temperature at lower power settings just

1151
01:10:03,380 --> 01:10:00,420
to maintain a minimum keep-alive power

1152
01:10:04,970 --> 01:10:03,390
if we needed to so we could operate just

1153
01:10:07,550 --> 01:10:04,980
the thermal systems just turn on things

1154
01:10:12,980 --> 01:10:07,560
to make sure that nothing freezes thank

1155
01:10:14,840 --> 01:10:12,990
you for dr. ting the substitution of the

1156
01:10:16,820 --> 01:10:14,850
the Magna the permanent magnet I know

1157
01:10:19,160 --> 01:10:16,830
that that all worked out really well

1158
01:10:22,580 --> 01:10:19,170
considering stations being extended but

1159
01:10:26,030 --> 01:10:22,590
could you just clarify if the helium

1160
01:10:28,370 --> 01:10:26,040
tank problems had any any impact on the

1161
01:10:34,070 --> 01:10:28,380
decision to switch and also are there

1162
01:10:39,830 --> 01:10:34,080
he plans for a for using the AMS cryo

1163
01:10:44,930 --> 01:10:39,840

magnet in like an AMS 3 thanks answer

1164
01:10:47,720 --> 01:10:44,940
the second part MSO to presumably the

1165
01:10:51,500 --> 01:10:47,730
last 20 years the space station there

1166
01:10:55,729 --> 01:10:51,510
people talk about ending 228 at least 20

1167
01:10:59,840 --> 01:10:55,739
to 20 so indeed there are many people

1168
01:11:02,390 --> 01:10:59,850
talking about ms 03 but perhaps for me

1169
01:11:13,270 --> 01:11:02,400
this is not my highest priority at this

1170
01:11:25,790 --> 01:11:18,919
has not been has not started and we were

1171
01:11:31,930 --> 01:11:25,800
given three years and there was a very

1172
01:11:36,169 --> 01:11:31,940
clear understanding between tue and nasa

1173
01:11:39,560 --> 01:11:36,179
we were to be on the space station for

1174
01:11:43,100 --> 01:11:39,570
three years afterwards will be returned

1175
01:11:44,990 --> 01:11:43,110
to earth another experiment will come on

1176
01:11:49,850 --> 01:11:45,000
i think i experiment was identified a

1177
01:11:54,110 --> 01:11:49,860
call access my memories correct so we

1178
01:11:57,080 --> 01:11:54,120
designed the magnet for three years it

1179
01:11:59,300 --> 01:11:57,090
is very difficult to build such a magnet

1180
01:12:02,689 --> 01:11:59,310
nobody has ever succeeded because you

1181
01:12:06,229 --> 01:12:02,699
need to cool such a low temperature so

1182
01:12:11,240 --> 01:12:06,239
we had many technical challenges but we

1183
01:12:15,379 --> 01:12:11,250
managed to finish them and we test them

1184
01:12:17,209 --> 01:12:15,389
in the thermal bacon tank in aztec

1185
01:12:19,100 --> 01:12:17,219
because you can attach them in the

1186
01:12:21,890 --> 01:12:19,110
laboratory in laboratory the outside

1187
01:12:24,470 --> 01:12:21,900
temperature and you have a 0 and so

1188
01:12:27,110 --> 01:12:24,480

conduct the heat so so you never get it

1189
01:12:30,770 --> 01:12:27,120
you never get a reliable answer until

1190
01:12:35,479 --> 01:12:30,780
you go to the thermal vacuum tank you

1191
01:12:38,330 --> 01:12:35,489
you pump down the vacuum tank and you

1192
01:12:44,729 --> 01:12:41,910
the environment temperature to simulated

1193
01:12:48,450 --> 01:12:44,739
space move there for quite quite some

1194
01:12:55,250 --> 01:12:48,460
time until the temperature in the tank

1195
01:13:00,209 --> 01:12:55,260
is stable 2.0 point zero zero zero one

1196
01:13:03,630 --> 01:13:00,219
degree per hour namely a dream it is

1197
01:13:06,990 --> 01:13:03,640
stable and then you can see how much

1198
01:13:11,160 --> 01:13:07,000
heat is going to coming into to lose it

1199
01:13:18,570 --> 01:13:11,170
and that turn out to be I think close to

1200
01:13:22,220 --> 01:13:18,580
three years 28 plus minus six months so

1201
01:13:25,050 --> 01:13:22,230
that should be ok because in space

1202
01:13:27,689 --> 01:13:25,060
whether its two-year you approved for

1203
01:13:33,020 --> 01:13:27,699
two years for three years you work for

1204
01:13:40,229 --> 01:13:36,600
whom finishes I remember very clear that

1205
01:13:43,830 --> 01:13:40,239
it was a project in last year and there

1206
01:13:50,130 --> 01:13:43,840
was announcements pay station will go to

1207
01:13:54,689 --> 01:13:50,140
2020 maybe go to 20 28 and then my

1208
01:13:58,280 --> 01:13:54,699
colleague and myself realized there's no

1209
01:14:03,030 --> 01:13:58,290
more shuttle so there's no review

1210
01:14:05,189 --> 01:14:03,040
there's no more shuttle to bring back if

1211
01:14:10,140 --> 01:14:05,199
you don't do something this will become

1212
01:14:14,880 --> 01:14:10,150
a museum piece and that's why we made a

1213
01:14:19,470 --> 01:14:14,890

decision to change the mac we have

1214
01:14:25,410 --> 01:14:19,480
studied this change before during the

1215
01:14:27,810 --> 01:14:25,420
period or after manifest would think of

1216
01:14:34,070 --> 01:14:27,820
going up with a satellite or going up

1217
01:14:41,939 --> 01:14:39,900
important very fortunate for us in arson

1218
01:14:44,010 --> 01:14:41,949
in the first institute of physics in off

1219
01:14:47,930 --> 01:14:44,020
in germany where Professor shear is the

1220
01:14:49,709 --> 01:14:47,940
director they have a very precise

1221
01:14:53,000 --> 01:14:49,719
machine shop

1222
01:14:58,439 --> 01:14:53,010
and we were able to do this very quickly

1223
01:15:02,310 --> 01:14:58,449
how long was it few weeks hmm six weeks

1224
01:15:05,399 --> 01:15:02,320
we changed America but we've understood

1225
01:15:09,120 --> 01:15:05,409
the step is not we have started random

1226
01:15:13,229 --> 01:15:09,130
over under through the steps and the way

1227
01:15:16,589 --> 01:15:13,239
to compensate the manganese week we add

1228
01:15:22,100 --> 01:15:16,599
more detectors and that also was down

1229
01:15:31,830 --> 01:15:24,989
think we were waiting one day of our

1230
01:15:34,049 --> 01:15:31,840
schedule marshaled an associated press

1231
01:15:35,580 --> 01:15:34,059
alpha leader if you i'm wondering if two

1232
01:15:38,330 --> 01:15:35,590
billion dollars is still the most

1233
01:15:41,100 --> 01:15:38,340
up-to-date accurate figure for the cause

1234
01:15:44,250 --> 01:15:41,110
jmsn are there also annual operating

1235
01:15:50,790 --> 01:15:44,260
costs they're very good to share with

1236
01:15:53,729 --> 01:15:50,800
all the different countries involve a

1237
01:15:55,290 --> 01:15:53,739
this is difficult simply because we have

1238
01:15:57,930 --> 01:15:55,300

all the different institutes many of the

1239
01:16:01,200 --> 01:15:57,940
many institutes provide in kind work or

1240
01:16:03,180 --> 01:16:01,210
they're only provide you know three grad

1241
01:16:06,149 --> 01:16:03,190
students and a professor and they don't

1242
01:16:08,339 --> 01:16:06,159
tell us how much those cost so over the

1243
01:16:10,140 --> 01:16:08,349
years I've been asked multiple times to

1244
01:16:12,029 --> 01:16:10,150
come up with the cost of a ms 2 billion

1245
01:16:14,219 --> 01:16:12,039
dollars is the number right now that i

1246
01:16:17,939 --> 01:16:14,229
would say AMS has cost since the

1247
01:16:21,109 --> 01:16:17,949
beginning since 1994 there are annual

1248
01:16:23,459 --> 01:16:21,119
operating costs most most of those are

1249
01:16:26,279 --> 01:16:23,469
borne by the by the collaboration

1250
01:16:28,020 --> 01:16:26,289
themselves once they move the payload

1251
01:16:32,129 --> 01:16:28,030
operation control center to cern to

1252
01:16:36,689 --> 01:16:32,139
Geneva as they man that with 12 to 15

1253
01:16:38,399 --> 01:16:36,699
people per shift 24 hours a day so that

1254
01:16:39,839 --> 01:16:38,409
gives you an idea of the number of

1255
01:16:42,660 --> 01:16:39,849
people that they will have to have in

1256
01:16:44,879 --> 01:16:42,670
place just for the operations obviously

1257
01:16:46,919 --> 01:16:44,889
they'll they'll share some of the duties

1258
01:16:50,219 --> 01:16:46,929
of operations as well as science

1259
01:16:52,290 --> 01:16:50,229
analysis and only much professor ting on

1260
01:16:54,060 --> 01:16:52,300
the science science teams that will be

1261
01:16:56,520 --> 01:16:54,070
throughout the world clearly those will

1262
01:17:01,950 --> 01:16:56,530
cost something as well mostly borne by

1263
01:17:11,590 --> 01:17:06,870

very difficult to estimate because

1264
01:17:17,680 --> 01:17:11,600
there's a tremendous difference in each

1265
01:17:20,290 --> 01:17:17,690
country how people get paid then you

1266
01:17:25,330 --> 01:17:20,300
touch this you become a very sensitive

1267
01:17:30,780 --> 01:17:25,340
subject and so lots of what NASA has

1268
01:17:36,550 --> 01:17:30,790
done is if this is to be done in NASA Oh

1269
01:17:37,930 --> 01:17:36,560
am i right how much this will cause we

1270
01:17:40,330 --> 01:17:37,940
essentially took the total number of

1271
01:17:42,340 --> 01:17:40,340
eight hours and said here's a typical

1272
01:17:45,130 --> 01:17:42,350
man our rate if we were doing it here in

1273
01:17:49,000 --> 01:17:45,140
the states will assume it's the same in

1274
01:17:50,380 --> 01:17:49,010
Taiwan earn in Spain or in Germany and

1275
01:17:52,420 --> 01:17:50,390
we'll multiply out the numbers and we'll

1276
01:17:55,300 --> 01:17:52,430
come up with them with the final number

1277
01:17:59,680 --> 01:17:55,310
the operating costs for NASA over the

1278
01:18:01,780 --> 01:17:59,690
next few years will be minimal less than

1279
01:18:04,000 --> 01:18:01,790
a million dollars a year for us to to

1280
01:18:07,300 --> 01:18:04,010
man the equipment that we need here

1281
01:18:09,100 --> 01:18:07,310
that's obviously not counting the space

1282
01:18:11,140 --> 01:18:09,110
station cost effect the space station is

1283
01:18:15,820 --> 01:18:11,150
up there but for my office the cost will

1284
01:18:17,740 --> 01:18:15,830
be mental Jim Oberg for NBC News I know

1285
01:18:21,040 --> 01:18:17,750
your general plan is to just watch the

1286
01:18:23,890 --> 01:18:21,050
sky for what falls into the detector do

1287
01:18:26,950 --> 01:18:23,900
you have any models in which you might

1288
01:18:29,980 --> 01:18:26,960

want to aim at a specific area of the

1289
01:18:32,530 --> 01:18:29,990
sky for some specific Astrophysical

1290
01:18:35,290 --> 01:18:32,540
event that's going on that you might

1291
01:18:42,840 --> 01:18:35,300
want to ask the station can you go look

1292
01:18:47,470 --> 01:18:42,850
at this location at this moment not yet

1293
01:18:50,710 --> 01:18:47,480
the calls for a charged particle it

1294
01:18:54,100 --> 01:18:50,720
bends in the intergalactic magnetic

1295
01:18:55,840 --> 01:18:54,110
field in the between the galaxies their

1296
01:18:59,170 --> 01:18:55,850
magnetic field as you don't know that

1297
01:19:01,390 --> 01:18:59,180
you don't know where to point the

1298
01:19:05,070 --> 01:19:01,400
pointing is not important it is

1299
01:19:09,780 --> 01:19:05,080
important who make very high-energy

1300
01:19:12,830 --> 01:19:09,790
light rays indeed we'll have it

1301
01:19:16,710 --> 01:19:12,840
p.s system will have two very precise

1302
01:19:19,260 --> 01:19:16,720
star tracker so we follow we also made a

1303
01:19:22,530 --> 01:19:19,270
lightweight and extremely high energies

1304
01:19:25,410 --> 01:19:22,540
to treating the electron bone and with

1305
01:19:28,170 --> 01:19:25,420
very high accuracy because I mentioned

1306
01:19:31,440 --> 01:19:28,180
at the end who have a stack of 17

1307
01:19:35,060 --> 01:19:31,450
radiations of the detector specially

1308
01:19:38,160 --> 01:19:35,070
major major light rays and for that

1309
01:19:44,460 --> 01:19:38,170
indeed if it's something new at very

1310
01:19:47,970 --> 01:19:44,470
high energy we may come to present this

1311
01:19:51,840 --> 01:19:47,980
to nasa to ask for a special orientation

1312
01:19:55,200 --> 01:19:51,850
but at this moment no I'm sorry to

1313
01:19:57,600 --> 01:19:55,210

bother hi clara moskowitz with space

1314
01:19:59,760 --> 01:19:57,610
calm and I know that you've talked about

1315
01:20:02,550 --> 01:19:59,770
the long saga of getting final approval

1316
01:20:04,680 --> 01:20:02,560
for this experiment and for a while the

1317
01:20:06,510 --> 01:20:04,690
question of whether or not the sts-134

1318
01:20:08,550 --> 01:20:06,520
flight would even go up was up in the

1319
01:20:10,530 --> 01:20:08,560
air can you talk about what you felt

1320
01:20:12,920 --> 01:20:10,540
when you learned that this flight was

1321
01:20:21,500 --> 01:20:12,930
actually going to launch your experiment

1322
01:20:25,560 --> 01:20:21,510
but it's better he answer we knew we

1323
01:20:27,330 --> 01:20:25,570
were asked that at NASA at JSC we were

1324
01:20:29,880 --> 01:20:27,340
asked to continue processing the payload

1325
01:20:30,930 --> 01:20:29,890
as if it were going into the shuttle we

1326
01:20:34,590 --> 01:20:30,940
were also told that we didn't have a

1327
01:20:36,180 --> 01:20:34,600
shuttle in the same breath it was it was

1328
01:20:38,880 --> 01:20:36,190
difficult and it was difficult to keep

1329
01:20:41,520 --> 01:20:38,890
the team together and so just the mere

1330
01:20:44,430 --> 01:20:41,530
fact of adding sts-134 was a relief to

1331
01:20:45,960 --> 01:20:44,440
my team who had been continuously

1332
01:20:52,290 --> 01:20:45,970
working on this not knowing whether or

1333
01:20:55,380 --> 01:20:52,300
not they had mission hi Mike Cronin from

1334
01:20:57,300 --> 01:20:55,390
the daily we know that we don't know

1335
01:20:59,880 --> 01:20:57,310
what dark matter is I know a little bit

1336
01:21:01,890 --> 01:20:59,890
about antimatter but have a little fun

1337
01:21:06,960 --> 01:21:01,900
with this question what do you think we

1338
01:21:10,050 --> 01:21:06,970

might find using this AMS about dark

1339
01:21:13,350 --> 01:21:10,060
matter and what might that knowledge

1340
01:21:17,070 --> 01:21:13,360
lead us to do whether it's interstellar

1341
01:21:20,100 --> 01:21:17,080
travel or the existence of opposite

1342
01:21:22,310 --> 01:21:20,110
charged beings that mirror ourselves or

1343
01:21:24,689 --> 01:21:22,320
something like that

1344
01:21:29,930 --> 01:21:24,699
you don't want me to answer this

1345
01:21:33,270 --> 01:21:29,940
question because I'm not qualified

1346
01:21:38,160 --> 01:21:33,280
anything most physicists who predict the

1347
01:21:41,720 --> 01:21:38,170
future normally end up regretting not

1348
01:21:44,399 --> 01:21:41,730
very difficult to predict the future my

1349
01:21:46,859 --> 01:21:44,409
responsibility and the responsibility of

1350
01:21:49,709 --> 01:21:46,869
my senior collaborators is to make sure

1351
01:21:52,529 --> 01:21:49,719
the instrument is correct because the

1352
01:21:55,259 --> 01:21:52,539
detector is so sensitive everything we

1353
01:22:00,029 --> 01:21:55,269
measure if something you will one make

1354
01:22:03,120 --> 01:22:00,039
sure it's done correctly speculation is

1355
01:22:08,189 --> 01:22:03,130
dangerous okay I think we have one

1356
01:22:10,799 --> 01:22:08,199
question at Kennedy Space Center just

1357
01:22:14,000 --> 01:22:10,809
one todd halvorson of florida today i'm

1358
01:22:17,189 --> 01:22:14,010
just wondering if professor tin can

1359
01:22:20,279 --> 01:22:17,199
speak to the difference in capabilities

1360
01:22:24,120 --> 01:22:20,289
of the cryo magnet and the permanent

1361
01:22:27,479 --> 01:22:24,130
magnet place yes very good question

1362
01:22:32,399 --> 01:22:27,489
permanent magnet does not require power

1363
01:22:35,310 --> 01:22:32,409

supply and because its way it's so

1364
01:22:38,939 --> 01:22:35,320
massive it doesn't the temperature is

1365
01:22:43,319 --> 01:22:38,949
easy to keep a constant require no

1366
01:22:46,859 --> 01:22:43,329
maintenance and our permanent magnet

1367
01:22:49,589 --> 01:22:46,869
will have shown in 12 years the magnetic

1368
01:22:52,200 --> 01:22:49,599
field has now changed and therefore in

1369
01:22:56,520 --> 01:22:52,210
20 to 30 years we'll keep it the same

1370
01:22:59,459 --> 01:22:56,530
magnetic field the disadvantage is the

1371
01:23:01,890 --> 01:22:59,469
field is much weaker five times weaker

1372
01:23:04,319 --> 01:23:01,900
than the superconducting likely to

1373
01:23:07,649 --> 01:23:04,329
compensate that we're putting more

1374
01:23:10,560 --> 01:23:07,659
detectors and more longer arms so

1375
01:23:13,200 --> 01:23:10,570
increase the measurement accuracy and so

1376
01:23:18,750 --> 01:23:13,210
the detector resolution with the

1377
01:23:21,400 --> 01:23:18,760
permanent magnet is not compromised I've

1378
01:23:24,370 --> 01:23:21,410
answer your question

1379
01:23:26,620 --> 01:23:24,380
I think so i think that is the end of

1380
01:23:28,840 --> 01:23:26,630
our briefing today next up coming up on

1381
01:23:32,110 --> 01:23:28,850
NASA TV 11 a.m. central time we'll have