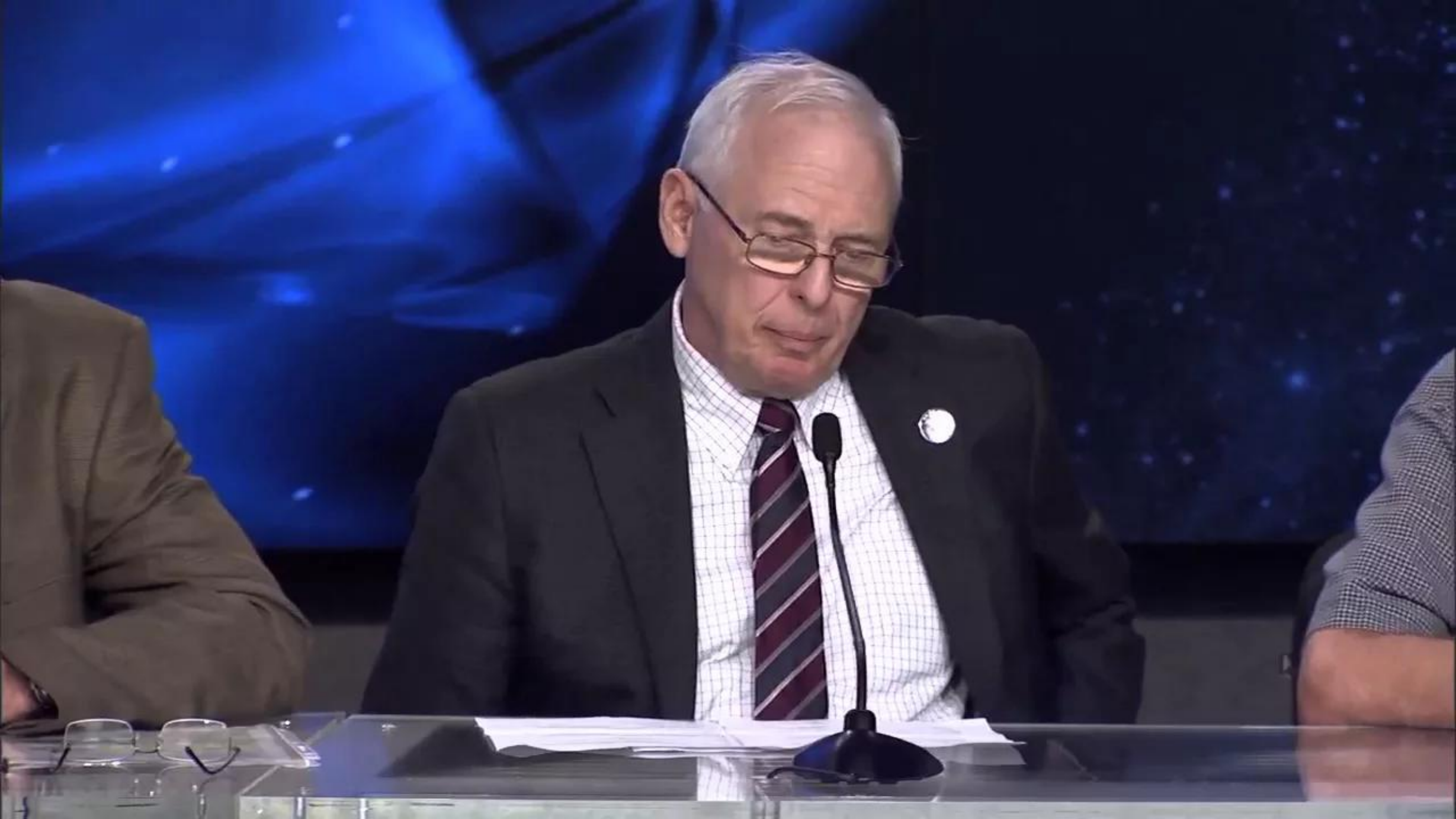

1
00:00:09,430 --> 00:00:07,110
good afternoon everyone this is our

2
00:00:12,310 --> 00:00:09,440
pre-launch news conference for nasa's

3
00:00:13,589 --> 00:00:12,320
multospheric multi-scale mission or mms

4
00:00:16,390 --> 00:00:13,599
as we know it

5
00:00:18,630 --> 00:00:16,400
and here to talk about the launch and

6
00:00:21,429 --> 00:00:18,640
the mission that's coming up

7
00:00:23,750 --> 00:00:21,439
is jeffrey yoder deputy associate

8
00:00:27,589 --> 00:00:23,760
administrator for the nasa science

9
00:00:31,990 --> 00:00:30,790
omar baez the nasa launch manager during

10
00:00:35,910 --> 00:00:32,000
the countdown

11
00:00:41,030 --> 00:00:38,470
vernon thorpe program manager for nasa

12
00:00:45,190 --> 00:00:41,040
missions from the united launch alliance

13
00:00:50,790 --> 00:00:48,709

craig thule the nasa mms project manager

14
00:00:54,150 --> 00:00:50,800
from the goddard space flight center in

15
00:00:58,950 --> 00:00:56,549
jim burch the principal investigator

16
00:01:02,310 --> 00:00:58,960
from the southwest research institute in

17
00:01:08,310 --> 00:01:04,630
and clay flynn the launch weather

18
00:01:10,070 --> 00:01:08,320
officer from the 45th weather squadron

19
00:01:11,270 --> 00:01:10,080
and we'll begin first with opening

20
00:01:13,429 --> 00:01:11,280
remarks

21
00:01:15,190 --> 00:01:13,439
from jeffrey yoder jeff

22
00:01:18,070 --> 00:01:15,200
thank you george

23
00:01:21,030 --> 00:01:18,080
this week is an exciting week for nasa

24
00:01:24,469 --> 00:01:21,040
our partners contractors as we prepare

25
00:01:26,230 --> 00:01:24,479
to launch four spacecraft to help

26
00:01:28,550 --> 00:01:26,240
solve the mysteries of how magnetic

27
00:01:30,469 --> 00:01:28,560
fields around the earth connect and

28
00:01:32,310 --> 00:01:30,479
disconnect

29
00:01:34,230 --> 00:01:32,320
and you'll hear more about that in our

30
00:01:37,030 --> 00:01:34,240
science briefing tomorrow

31
00:01:39,749 --> 00:01:37,040
but mms is a challenging mission and if

32
00:01:42,310 --> 00:01:39,759
it's possible because of the uh the hard

33
00:01:44,069 --> 00:01:42,320
work and dedication of this uh of this

34
00:01:46,469 --> 00:01:44,079
great team

35
00:01:49,270 --> 00:01:46,479
and it would be difficult for me to uh

36
00:01:52,469 --> 00:01:49,280
to name and mention everybody by name

37
00:01:56,069 --> 00:01:52,479
who was involved but i would like to uh

38
00:01:57,429 --> 00:01:56,079

to reference uh or to say thanks to our

39
00:02:00,789 --> 00:01:57,439
certainly the nasa team our

40
00:02:03,190 --> 00:02:00,799
international partners our contractors

41
00:02:05,749 --> 00:02:03,200
universities and our launch providers

42
00:02:07,429 --> 00:02:05,759
from for making this happen today

43
00:02:09,830 --> 00:02:07,439
i would also want to spend time just to

44
00:02:11,510 --> 00:02:09,840
say thank you to the the families that

45
00:02:13,110 --> 00:02:11,520
allowed your

46
00:02:15,430 --> 00:02:13,120
your loved ones to really spend this

47
00:02:17,510 --> 00:02:15,440
last five plus years working on this

48
00:02:19,510 --> 00:02:17,520
amazing mission

49
00:02:21,350 --> 00:02:19,520
you were part of the success of getting

50
00:02:23,350 --> 00:02:21,360
us to this point also so i'd like to say

51
00:02:26,150 --> 00:02:23,360
thank you to to the families that

52
00:02:29,350 --> 00:02:26,160
sacrificed your time george thank you

53
00:02:30,949 --> 00:02:29,360
jeff and now to omar baez who is our

54
00:02:32,150 --> 00:02:30,959
nasa launch manager in the countdown

55
00:02:33,509 --> 00:02:32,160
tomorrow night

56
00:02:34,790 --> 00:02:33,519
omar

57
00:02:36,390 --> 00:02:34,800
thank you george

58
00:02:38,710 --> 00:02:36,400
and good afternoon everyone and thank

59
00:02:40,790 --> 00:02:38,720
you for attending today's brief

60
00:02:41,910 --> 00:02:40,800
i am again fortunate to to be here

61
00:02:44,470 --> 00:02:41,920
representing

62
00:02:46,949 --> 00:02:44,480
the men and women of the nasa launch

63
00:02:49,190 --> 00:02:46,959

services program at kennedy space center

64
00:02:51,430 --> 00:02:49,200
and our partners united launch

65
00:02:52,790 --> 00:02:51,440
alliance and our customer goddard space

66
00:02:54,710 --> 00:02:52,800
flight center

67
00:02:57,110 --> 00:02:54,720
these folks have been dedicated to

68
00:02:59,350 --> 00:02:57,120
analyzing fabricating assembling

69
00:03:01,589 --> 00:02:59,360
preparing and testing the atlas v and

70
00:03:04,229 --> 00:03:01,599
the four mms spacecraft

71
00:03:07,830 --> 00:03:04,239
which is set for launch this thursday at

72
00:03:11,509 --> 00:03:09,830
this will be the 53rd flight of the

73
00:03:14,309 --> 00:03:11,519
atlas 5

74
00:03:15,990 --> 00:03:14,319
launch vehicle this will be the fourth

75
00:03:18,630 --> 00:03:16,000
time this

76
00:03:20,710 --> 00:03:18,640
421 configuration is used

77
00:03:24,149 --> 00:03:20,720
and that is the 400 series

78
00:03:25,830 --> 00:03:24,159
rocket with two solid rocket motors

79
00:03:28,229 --> 00:03:25,840
and we are using an extended payload

80
00:03:29,990 --> 00:03:28,239
fairing for it

81
00:03:31,910 --> 00:03:30,000
we'll have a short video if you could

82
00:03:33,910 --> 00:03:31,920
roll that i'm going to show you how this

83
00:03:35,430 --> 00:03:33,920
is two or three months process is done

84
00:03:37,350 --> 00:03:35,440
in a minute

85
00:03:40,390 --> 00:03:37,360
that's the booster arriving on the foss

86
00:03:43,110 --> 00:03:40,400
mariner from decatur alabama and it's on

87
00:03:45,430 --> 00:03:43,120
its way to the asoc facility this is the

88
00:03:50,390 --> 00:03:45,440

booster on the way up to the pad as it's

89
00:03:57,270 --> 00:03:54,869
engine using kerosene and liquid oxygen

90
00:03:58,949 --> 00:03:57,280
as i said before it's got two solid

91
00:04:01,509 --> 00:03:58,959
rocket motors and those are being

92
00:04:03,830 --> 00:04:01,519
erected there and the top of the stage

93
00:04:05,830 --> 00:04:03,840
is the centaur powered by the aerojet

94
00:04:07,750 --> 00:04:05,840
rocketdyne rl10a

95
00:04:10,470 --> 00:04:07,760
and that's the

96
00:04:12,630 --> 00:04:10,480
centaur there

97
00:04:14,550 --> 00:04:12,640
that stage is powered by a hydrogen and

98
00:04:16,310 --> 00:04:14,560
liquid oxygen

99
00:04:21,830 --> 00:04:16,320
and

100
00:04:24,230 --> 00:04:21,840
four mms spacecraft which you see there

101
00:04:28,950 --> 00:04:24,240
in the payload fairing

102
00:04:30,790 --> 00:04:28,960
to its intended orbit um the four mms

103
00:04:33,749 --> 00:04:30,800
spacecraft were encapsulated within that

104
00:04:35,590 --> 00:04:33,759
four meter fairing uh two weeks ago in

105
00:04:36,950 --> 00:04:35,600
astrotech and they were brought over to

106
00:04:39,110 --> 00:04:36,960
the cape

107
00:04:40,390 --> 00:04:39,120
they were stacked on friday february the

108
00:04:41,430 --> 00:04:40,400
29th

109
00:04:49,189 --> 00:04:41,440
and

110
00:04:49,990 --> 00:04:49,199
integrated systems test to make sure

111
00:04:51,350 --> 00:04:50,000
that

112
00:04:53,590 --> 00:04:51,360
uh all the

113
00:04:55,990 --> 00:04:53,600

electrical paths through the spacecraft

114
00:04:57,909 --> 00:04:56,000
and the launch vehicle are working

115
00:05:00,390 --> 00:04:57,919
correctly

116
00:05:01,830 --> 00:05:00,400
last friday we completed our flight

117
00:05:04,230 --> 00:05:01,840
readiness review

118
00:05:05,510 --> 00:05:04,240
yesterday we did our mission dress

119
00:05:07,749 --> 00:05:05,520
rehearsal

120
00:05:11,350 --> 00:05:07,759
and this morning we successfully held

121
00:05:13,430 --> 00:05:11,360
the nasa launch readiness review

122
00:05:15,670 --> 00:05:13,440
we plan to roll the vehicle out of the

123
00:05:17,270 --> 00:05:15,680
vertical integration facility tomorrow

124
00:05:19,189 --> 00:05:17,280
at 10 in the morning

125
00:05:20,390 --> 00:05:19,199
we will connect the electrical fluid and

126
00:05:22,230 --> 00:05:20,400
pneumatic

127
00:05:23,110 --> 00:05:22,240
and environmental control system up to

128
00:05:30,310 --> 00:05:23,120
the

129
00:05:31,510 --> 00:05:30,320
atlas v booster

130
00:05:34,150 --> 00:05:31,520
and

131
00:05:36,390 --> 00:05:34,160
the following day just after 3 p.m this

132
00:05:38,469 --> 00:05:36,400
is thursday the team will power up the

133
00:05:40,310 --> 00:05:38,479
atlas and the centaur perform the flight

134
00:05:43,270 --> 00:05:40,320
control checks

135
00:05:45,029 --> 00:05:43,280
we will get into our facility chill down

136
00:05:47,430 --> 00:05:45,039
our launch management team should be in

137
00:05:50,230 --> 00:05:47,440
place by about 6 pm

138
00:05:53,029 --> 00:05:50,240

and at 7 44

139
00:05:55,029 --> 00:05:53,039
we will have our first hold at t minus

140
00:05:57,029 --> 00:05:55,039
two hours this is a 30 minute hold at

141
00:05:58,550 --> 00:05:57,039
the conclusion uphold

142
00:06:01,110 --> 00:05:58,560
we'll give concurrence to proceed with

143
00:06:03,029 --> 00:06:01,120
cryogenic tanking

144
00:06:05,029 --> 00:06:03,039
approximately two hours later we will be

145
00:06:07,350 --> 00:06:05,039
done with cryogenic tanking and we will

146
00:06:09,590 --> 00:06:07,360
enter our 30-minute hold at t-minus four

147
00:06:12,309 --> 00:06:09,600
minutes and that will occur roughly at

148
00:06:14,230 --> 00:06:12,319
uh 8 10 p.m

149
00:06:16,390 --> 00:06:14,240
at 10 30 i will pull the team for

150
00:06:19,110 --> 00:06:16,400
concurrence to enter terminal count and

151
00:06:20,710 --> 00:06:19,120
release the hold at t minus four minutes

152
00:06:23,189 --> 00:06:20,720
and after confirmation that the

153
00:06:24,870 --> 00:06:23,199
spacecraft is configured for launch at

154
00:06:26,870 --> 00:06:24,880
about four and a half minutes i will

155
00:06:28,790 --> 00:06:26,880
inform the ula launch director that nasa

156
00:06:30,950 --> 00:06:28,800
is go for launch the expected t-zero

157
00:06:33,029 --> 00:06:30,960
tomorrow is at 10 44

158
00:06:35,350 --> 00:06:33,039
p.m and we have 30 minutes a launch

159
00:06:36,950 --> 00:06:35,360
window

160
00:06:37,909 --> 00:06:36,960
back to you george all right thank you

161
00:06:40,469 --> 00:06:37,919
omar

162
00:06:42,629 --> 00:06:40,479
and to vernon thorpe the program manager

163
00:06:44,150 --> 00:06:42,639

for nasa missions from united launch

164
00:06:46,309 --> 00:06:44,160
alliance vern

165
00:06:48,710 --> 00:06:46,319
hey thank you george united launch

166
00:06:50,550 --> 00:06:48,720
alliance is honored to be here again

167
00:06:52,150 --> 00:06:50,560
with all of our nasa customers just two

168
00:06:53,430 --> 00:06:52,160
days before the launch of the mms

169
00:06:55,350 --> 00:06:53,440
mission

170
00:06:58,309 --> 00:06:55,360
our ula team actually started working

171
00:07:01,350 --> 00:06:58,319
with nasa to integrate mms onto an atlas

172
00:07:03,589 --> 00:07:01,360
5 almost six years ago back in 2009

173
00:07:05,670 --> 00:07:03,599
that's a little bit longer than

174
00:07:07,189 --> 00:07:05,680
we usually work on these missions it had

175
00:07:09,189 --> 00:07:07,199
a this mission had an unusually long

176
00:07:11,029 --> 00:07:09,199
integration period which allowed us to

177
00:07:14,230 --> 00:07:11,039
work with the spacecraft team to define

178
00:07:17,670 --> 00:07:14,240
interfaces and environments early which

179
00:07:20,629 --> 00:07:17,680
allowed for some requirements stability

180
00:07:22,070 --> 00:07:20,639
and definition of environments early

181
00:07:24,390 --> 00:07:22,080
which

182
00:07:26,710 --> 00:07:24,400
ended up resulting in lower risk for

183
00:07:28,469 --> 00:07:26,720
this very complex mission

184
00:07:29,990 --> 00:07:28,479
after defining the requirements early we

185
00:07:31,830 --> 00:07:30,000
were able to ramp down the integration

186
00:07:34,309 --> 00:07:31,840
effort for a while and then we returned

187
00:07:35,830 --> 00:07:34,319
to more of a normal schedule a couple of

188
00:07:38,629 --> 00:07:35,840

years ago when we got into the the

189
00:07:41,909 --> 00:07:38,639
normal two years before launch

190
00:07:43,990 --> 00:07:41,919
mms will be the final atlas mission to

191
00:07:46,550 --> 00:07:44,000
be launched on our original nasa launch

192
00:07:48,309 --> 00:07:46,560
services contract also known as the nls1

193
00:07:51,749 --> 00:07:48,319
contract

194
00:07:53,510 --> 00:07:51,759
lsp customer

195
00:07:54,790 --> 00:07:53,520
and we do have quite a few other nasa

196
00:07:56,309 --> 00:07:54,800
missions that are being integrated for

197
00:07:59,589 --> 00:07:56,319
flight in the future those are all being

198
00:08:02,150 --> 00:07:59,599
integrated under the newer nls2 contract

199
00:08:04,150 --> 00:08:02,160
so this one will close out nls1

200
00:08:06,710 --> 00:08:04,160
we began building the atlas 5 for this

201
00:08:07,909 --> 00:08:06,720
mms mission indicator alabama about two

202
00:08:09,430 --> 00:08:07,919
years ago

203
00:08:11,270 --> 00:08:09,440
we started the technical integration

204
00:08:13,270 --> 00:08:11,280
work a few years before that as i

205
00:08:15,029 --> 00:08:13,280
mentioned and we've analyzed and

206
00:08:17,029 --> 00:08:15,039
developed solutions for many unique

207
00:08:18,950 --> 00:08:17,039
requirements both physical interface

208
00:08:21,350 --> 00:08:18,960
requirements and

209
00:08:23,270 --> 00:08:21,360
operational requirements associated with

210
00:08:25,189 --> 00:08:23,280
this mission and we've tested and

211
00:08:27,430 --> 00:08:25,199
verified those solutions

212
00:08:29,189 --> 00:08:27,440
the ula lsp and goddard teams have

213
00:08:31,189 --> 00:08:29,199

worked very hard to get to this point

214
00:08:32,230 --> 00:08:31,199
it's been a tremendous team effort as

215
00:08:33,670 --> 00:08:32,240
always

216
00:08:35,829 --> 00:08:33,680
and we're all looking forward to a great

217
00:08:38,949 --> 00:08:35,839
launch on thursday night

218
00:08:41,909 --> 00:08:38,959
this will be ula's third launch of the

219
00:08:45,269 --> 00:08:41,919
year it'll be the 94th total launch

220
00:08:48,070 --> 00:08:45,279
since ula was formed back in 2006

221
00:08:50,630 --> 00:08:48,080
94 launches in just over eight years

222
00:08:53,509 --> 00:08:50,640
we have a very busy manifest in 2015

223
00:08:55,350 --> 00:08:53,519
with 13 launches planned and 10 of those

224
00:08:56,870 --> 00:08:55,360
will actually fly from here at cape

225
00:09:00,790 --> 00:08:56,880
canaveral

226
00:09:03,910 --> 00:09:00,800
mms will launch on an atlas 5 421

227
00:09:05,590 --> 00:09:03,920
the 421 configuration has that 4 meter

228
00:09:06,949 --> 00:09:05,600
diameter payload fairing that you saw a

229
00:09:09,590 --> 00:09:06,959
little earlier

230
00:09:11,269 --> 00:09:09,600
along with two aerojet rocketdyne solid

231
00:09:12,710 --> 00:09:11,279
rocket boosters attached to the atlas

232
00:09:14,230 --> 00:09:12,720
first stage

233
00:09:17,590 --> 00:09:14,240
the atlas booster for this mission will

234
00:09:19,190 --> 00:09:17,600
be powered by the rd amros rd-180 engine

235
00:09:22,630 --> 00:09:19,200
and the centaur upper stage will be

236
00:09:23,990 --> 00:09:22,640
powered by an aerojet rocketdyne rl10a

237
00:09:25,910 --> 00:09:24,000
engine

238
00:09:27,430 --> 00:09:25,920

and to give you a preview of what you'll

239
00:09:29,829 --> 00:09:27,440
see when the rocket flies on thursday

240
00:09:32,870 --> 00:09:29,839
night i'd like to show a short video can

241
00:09:36,710 --> 00:09:34,630
so here's the vehicle lifting off when

242
00:09:38,550 --> 00:09:36,720
we light the the core engine along with

243
00:09:42,070 --> 00:09:38,560
the two srbs we'll lift off with about

244
00:09:43,910 --> 00:09:42,080
1.5 million pounds of total thrust

245
00:09:46,710 --> 00:09:43,920
on this configuration vehicle the next

246
00:09:49,190 --> 00:09:46,720
major event that you'll see is burnout

247
00:09:50,550 --> 00:09:49,200
of the srbs those will burn out about 99

248
00:09:51,990 --> 00:09:50,560
seconds into flight

249
00:09:53,269 --> 00:09:52,000
we'll hang on to them for about another

250
00:09:55,509 --> 00:09:53,279
half a minute

251
00:09:57,430 --> 00:09:55,519
so that when we jettison them we'll be

252
00:09:58,630 --> 00:09:57,440
safely downrange there you see that

253
00:10:00,949 --> 00:09:58,640
happening

254
00:10:02,790 --> 00:10:00,959
the first stage propellant will be used

255
00:10:04,230 --> 00:10:02,800
up after about four minutes at that

256
00:10:06,310 --> 00:10:04,240
point we'll command booster engine

257
00:10:07,990 --> 00:10:06,320
cutoff like you see there six seconds

258
00:10:09,269 --> 00:10:08,000
later we'll separate from the centaur

259
00:10:11,590 --> 00:10:09,279
upper stage

260
00:10:13,430 --> 00:10:11,600
we spent a few seconds preparing for the

261
00:10:15,350 --> 00:10:13,440
first of two engine burns

262
00:10:18,389 --> 00:10:15,360
and then we'll light the engine

263
00:10:20,470 --> 00:10:18,399

that first engine burn will last

264
00:10:22,150 --> 00:10:20,480
just over nine minutes

265
00:10:23,990 --> 00:10:22,160
we'll jettison the payload fairing very

266
00:10:25,430 --> 00:10:24,000
early in that engine burn as you see

267
00:10:27,590 --> 00:10:25,440
there

268
00:10:29,990 --> 00:10:27,600
and then at the conclusion of that first

269
00:10:31,990 --> 00:10:30,000
engine burn we'll enter a parking orbit

270
00:10:34,949 --> 00:10:32,000
coast that lasts almost an hour it's a

271
00:10:36,230 --> 00:10:34,959
15 59 minute parking orbit coast at that

272
00:10:38,389 --> 00:10:36,240
point we'll be in position for the

273
00:10:40,630 --> 00:10:38,399
second engine burn that second burn will

274
00:10:42,470 --> 00:10:40,640
last five minutes and 41 seconds and

275
00:10:45,110 --> 00:10:42,480
that will put us into the orbit we want

276
00:10:47,030 --> 00:10:45,120
to be for spacecraft separation

277
00:10:48,710 --> 00:10:47,040
now we have a very unique separation

278
00:10:51,590 --> 00:10:48,720
sequence for this mission because of

279
00:10:53,670 --> 00:10:51,600
those four spacecraft

280
00:10:55,269 --> 00:10:53,680
we'll separate the first one 14 minutes

281
00:10:57,030 --> 00:10:55,279
after the second burn

282
00:10:59,829 --> 00:10:57,040
that will give us time to orient the

283
00:11:02,069 --> 00:10:59,839
spacecraft desired attitude and to

284
00:11:03,350 --> 00:11:02,079
stabilize the vehicle and then we will

285
00:11:05,190 --> 00:11:03,360
separate

286
00:11:07,190 --> 00:11:05,200
at five minute intervals

287
00:11:10,069 --> 00:11:07,200
so the time from the first separation to

288
00:11:12,069 --> 00:11:10,079

the fourth separation will be 15 minutes

289
00:11:14,550 --> 00:11:12,079
and what we want to do is we want to

290
00:11:15,910 --> 00:11:14,560
minimize disturbances

291
00:11:18,630 --> 00:11:15,920
on the upper stage between those

292
00:11:20,550 --> 00:11:18,640
separations so for about 20 minutes

293
00:11:24,069 --> 00:11:20,560
starting a few minutes before that first

294
00:11:25,750 --> 00:11:24,079
separation we'll actually lock up the

295
00:11:27,430 --> 00:11:25,760
propellant tank vents and we'll do

296
00:11:29,750 --> 00:11:27,440
everything else we can to keep that

297
00:11:31,509 --> 00:11:29,760
vehicle as as stable and rock solid as

298
00:11:33,590 --> 00:11:31,519
we possibly can so that we just have

299
00:11:35,829 --> 00:11:33,600
minimal disturbances between

300
00:11:37,590 --> 00:11:35,839
uh between separations

301
00:11:39,990 --> 00:11:37,600
prior to each separation we'll spin the

302
00:11:41,910 --> 00:11:40,000
vehicle up to about 3 rpm and then in

303
00:11:45,430 --> 00:11:41,920
between separations will spin back down

304
00:11:52,230 --> 00:11:48,470
this will actually be nasa's 12th

305
00:11:54,310 --> 00:11:52,240
mission to launch on an atlas v rocket

306
00:11:57,590 --> 00:11:54,320
and as you know atlas and deltas have

307
00:11:59,110 --> 00:11:57,600
been delivering uh nasa science missions

308
00:12:00,550 --> 00:11:59,120
and other important payloads to orbit

309
00:12:03,350 --> 00:12:00,560
for decades

310
00:12:05,190 --> 00:12:03,360
we're always focused relentlessly on

311
00:12:07,190 --> 00:12:05,200
delivering those critical capabilities

312
00:12:09,829 --> 00:12:07,200
to orbit and right now we're focused on

313
00:12:11,990 --> 00:12:09,839

our nasa customer and on the mms mission

314
00:12:13,509 --> 00:12:12,000
and i'd like to say thank you again to

315
00:12:16,310 --> 00:12:13,519
all of our mission partners who helped

316
00:12:17,750 --> 00:12:16,320
us get to this point and the entire ula

317
00:12:19,750 --> 00:12:17,760
team looks forward to a successful

318
00:12:21,269 --> 00:12:19,760
launch on thursday and with that i'll

319
00:12:22,710 --> 00:12:21,279
hand it back to you george all right

320
00:12:25,670 --> 00:12:22,720
thanks fern

321
00:12:27,910 --> 00:12:25,680
now to craig tooley the nasa mms project

322
00:12:29,829 --> 00:12:27,920
manager from goddard space flight center

323
00:12:32,389 --> 00:12:29,839
greg

324
00:12:34,150 --> 00:12:32,399
good afternoon um in a moment i'll i'll

325
00:12:36,069 --> 00:12:34,160
pick up where vern left off describing

326
00:12:37,350 --> 00:12:36,079
how the mission unfolds but before i do

327
00:12:39,590 --> 00:12:37,360
that i'd like to just say a few words

328
00:12:42,790 --> 00:12:39,600
about really the uh as we near the

329
00:12:44,230 --> 00:12:42,800
culmination of of well over five years

330
00:12:45,670 --> 00:12:44,240
of what is

331
00:12:47,110 --> 00:12:45,680
the development of probably one of the

332
00:12:49,030 --> 00:12:47,120
most challenging missions that both

333
00:12:51,990 --> 00:12:49,040
goddard space flight center as well as

334
00:12:53,190 --> 00:12:52,000
southwest research center has ever done

335
00:12:54,150 --> 00:12:53,200
as you can see from what you've seen

336
00:12:56,550 --> 00:12:54,160
already

337
00:12:59,030 --> 00:12:56,560
we have we have built four large

338
00:13:01,030 --> 00:12:59,040

identical very sensitive

339
00:13:02,949 --> 00:13:01,040
uh spinning spacecraft that we will fly

340
00:13:04,629 --> 00:13:02,959
in formation so

341
00:13:06,550 --> 00:13:04,639
you know here two days before launch i'm

342
00:13:08,790 --> 00:13:06,560
honored to have helped in concert with

343
00:13:11,190 --> 00:13:08,800
jim birch lead this team which at times

344
00:13:12,629 --> 00:13:11,200
was over 500 people

345
00:13:14,949 --> 00:13:12,639
building this mission which we're about

346
00:13:16,389 --> 00:13:14,959
to launch

347
00:13:18,310 --> 00:13:16,399
those that team has been made up of a

348
00:13:19,910 --> 00:13:18,320
variety of institutions but namely

349
00:13:21,190 --> 00:13:19,920
goddard space flight center southwest

350
00:13:24,150 --> 00:13:21,200
research center university of new

351
00:13:26,310 --> 00:13:24,160
hampshire and a whole plethora of other

352
00:13:28,310 --> 00:13:26,320
both domestic and international partners

353
00:13:29,269 --> 00:13:28,320
um if we could show the next the next

354
00:13:30,550 --> 00:13:29,279
video

355
00:13:31,590 --> 00:13:30,560
i hope

356
00:13:33,829 --> 00:13:31,600
so here we're gonna have a little bit of

357
00:13:35,430 --> 00:13:33,839
overlap um um you can see here we are

358
00:13:37,509 --> 00:13:35,440
about leading up to the separation

359
00:13:39,190 --> 00:13:37,519
sequence the the the centaurus is

360
00:13:41,750 --> 00:13:39,200
putting onto initial you see the fairing

361
00:13:44,230 --> 00:13:41,760
separation which we sense on board uh we

362
00:13:45,750 --> 00:13:44,240
are spun up to three rpm here um and

363
00:13:47,350 --> 00:13:45,760

we'll begin to separate now separation

364
00:13:49,269 --> 00:13:47,360
is actually separated

365
00:13:50,710 --> 00:13:49,279
by about five minutes so we sped up a

366
00:13:52,150 --> 00:13:50,720
little bit here so this press conference

367
00:13:54,389 --> 00:13:52,160
isn't too long

368
00:13:55,350 --> 00:13:54,399
but each mms spacecraft separates and in

369
00:13:56,870 --> 00:13:55,360
turn

370
00:13:58,949 --> 00:13:56,880
activates and then deactivates its

371
00:14:00,949 --> 00:13:58,959
transponder so we can talk to it you see

372
00:14:02,069 --> 00:14:00,959
here the first of our

373
00:14:04,310 --> 00:14:02,079
booms deploying these are the

374
00:14:06,870 --> 00:14:04,320
magnetometer booms five meters each that

375
00:14:08,870 --> 00:14:06,880
unfold the shortest of our booms all

376
00:14:10,790 --> 00:14:08,880
while we're spinning at three rpm

377
00:14:12,629 --> 00:14:10,800
now you'll see the uh illustration of

378
00:14:14,710 --> 00:14:12,639
the deployment of what we call our spin

379
00:14:17,269 --> 00:14:14,720
plane double pro booms these are 60

380
00:14:19,430 --> 00:14:17,279
meters on the side four wire booms which

381
00:14:20,790 --> 00:14:19,440
we deployed to sense electric fields

382
00:14:22,389 --> 00:14:20,800
while we're spinning obviously spinning

383
00:14:24,069 --> 00:14:22,399
to keep them taunt

384
00:14:25,910 --> 00:14:24,079
and then finally we're going to see here

385
00:14:27,829 --> 00:14:25,920
the deployment of the axial booms the

386
00:14:30,150 --> 00:14:27,839
one that go out in our spin direction

387
00:14:32,550 --> 00:14:30,160
which go out 15 meters at both ends and

388
00:14:34,550 --> 00:14:32,560

care and carry receiving elements to

389
00:14:37,670 --> 00:14:34,560
sense fields at their ends leaving us

390
00:14:39,750 --> 00:14:37,680
with with four spinning spacecraft with

391
00:14:42,310 --> 00:14:39,760
the boom spread out that actually have a

392
00:14:43,750 --> 00:14:42,320
footprint about the size of a baseball

393
00:14:44,949 --> 00:14:43,760
field

394
00:14:46,629 --> 00:14:44,959
and you see here in this view you can

395
00:14:48,150 --> 00:14:46,639
actually see the other mms as

396
00:14:51,350 --> 00:14:48,160
illustrating the formation although we

397
00:14:54,870 --> 00:14:51,360
fly these um as close as 10 kilometers

398
00:14:57,430 --> 00:14:54,880
together we will adjust that formation

399
00:14:59,670 --> 00:14:57,440
as we fly and as as jim burch will talk

400
00:15:01,350 --> 00:14:59,680
about which regions of space we actually

401
00:15:02,949 --> 00:15:01,360
do our science in we are we are

402
00:15:06,230 --> 00:15:02,959
continually fine-tuning this

403
00:15:07,990 --> 00:15:06,240
three-dimensional formation um so that

404
00:15:10,150 --> 00:15:08,000
we can capture magnetic reconnection

405
00:15:12,069 --> 00:15:10,160
it's best to think of this mission as an

406
00:15:14,310 --> 00:15:12,079
institute flying laboratory not really a

407
00:15:15,829 --> 00:15:14,320
remote sensing but it is operated

408
00:15:17,829 --> 00:15:15,839
throughout its two-year mission

409
00:15:19,509 --> 00:15:17,839
continuously by scientists on the ground

410
00:15:22,069 --> 00:15:19,519
essentially using our own magnetosphere

411
00:15:23,990 --> 00:15:22,079
as a laboratory now in the next video if

412
00:15:25,990 --> 00:15:24,000
we could roll that just get a little

413
00:15:27,430 --> 00:15:26,000

insight into how we fly there you see

414
00:15:29,110 --> 00:15:27,440
the mms

415
00:15:31,030 --> 00:15:29,120
observatories or spacecraft represented

416
00:15:32,949 --> 00:15:31,040
by those four dots

417
00:15:34,310 --> 00:15:32,959
flying in formation we they make up a

418
00:15:36,870 --> 00:15:34,320
tetrahedron so we can get a

419
00:15:38,710 --> 00:15:36,880
three-dimensional capture

420
00:15:40,230 --> 00:15:38,720
of magnetic reconnection events as close

421
00:15:42,150 --> 00:15:40,240
as 10 kilometers together you can see

422
00:15:44,069 --> 00:15:42,160
the magnetic fields represented there

423
00:15:47,590 --> 00:15:44,079
essentially when you fly something in

424
00:15:49,749 --> 00:15:47,600
formation you end up needing to fly four

425
00:15:51,269 --> 00:15:49,759
different but very similar orbits

426
00:15:53,910 --> 00:15:51,279
continuously and we have to we have to

427
00:15:56,069 --> 00:15:53,920
then fine-tune those orbits to maintain

428
00:15:58,790 --> 00:15:56,079
that formation we'll fly them as close

429
00:16:01,110 --> 00:15:58,800
as 10 kilometers together we'll we'll

430
00:16:03,670 --> 00:16:01,120
fly them with an accuracy of a hundred

431
00:16:05,269 --> 00:16:03,680
meters while we do that and as often as

432
00:16:07,509 --> 00:16:05,279
every two weeks we will we will do

433
00:16:09,590 --> 00:16:07,519
propulsive maneuvers we carry about 400

434
00:16:11,509 --> 00:16:09,600
kilograms of hydrazine rocket fuel on

435
00:16:12,389 --> 00:16:11,519
the board each one to do those maneuvers

436
00:16:14,389 --> 00:16:12,399
with

437
00:16:15,670 --> 00:16:14,399
now before i turn it over to uh to jim

438
00:16:17,269 --> 00:16:15,680

burch to tell you a little bit more

439
00:16:18,870 --> 00:16:17,279
about the science we'll move backwards

440
00:16:21,030 --> 00:16:18,880
in time a little bit and we'll run a

441
00:16:22,790 --> 00:16:21,040
little clip that shows just a little

442
00:16:24,949 --> 00:16:22,800
sample of what happened

443
00:16:26,710 --> 00:16:24,959
almost four months ago when we arrived

444
00:16:28,629 --> 00:16:26,720
as we as we began our journey from

445
00:16:30,629 --> 00:16:28,639
arrival here at the launch site to

446
00:16:31,749 --> 00:16:30,639
finally being encapsulated and on the

447
00:16:32,949 --> 00:16:31,759
rocket so if we could show the next

448
00:16:34,870 --> 00:16:32,959
video

449
00:16:37,749 --> 00:16:34,880
so here you can see we actually

450
00:16:39,910 --> 00:16:37,759
shipped the mms spacecraft to astrotech

451
00:16:41,829 --> 00:16:39,920
our payload processing facility two at a

452
00:16:43,590 --> 00:16:41,839
time a trans we reused a transporter so

453
00:16:45,829 --> 00:16:43,600
we made two trips and you can see in

454
00:16:48,310 --> 00:16:45,839
this you can see us actually unwrapping

455
00:16:50,150 --> 00:16:48,320
the first of the stack of two in that

456
00:16:52,550 --> 00:16:50,160
picture you can see you saw two mms

457
00:16:54,550 --> 00:16:52,560
observatories here's the arrival of the

458
00:16:57,030 --> 00:16:54,560
next two you'll see them lifted off

459
00:17:00,150 --> 00:16:57,040
these observatories are about each four

460
00:17:01,509 --> 00:17:00,160
feet tall about 12 feet across their

461
00:17:03,670 --> 00:17:01,519
octagonal

462
00:17:05,029 --> 00:17:03,680
cross section of course that's how big

463
00:17:06,789 --> 00:17:05,039

they are before we've deployed those

464
00:17:08,710 --> 00:17:06,799
booms i spoke of

465
00:17:10,630 --> 00:17:08,720
cleanliness is very important to us as

466
00:17:12,630 --> 00:17:10,640
is magnetic cleanliness as was

467
00:17:15,590 --> 00:17:12,640
electrostatic these are extremely clean

468
00:17:17,510 --> 00:17:15,600
spacecraft lest we measure our own noise

469
00:17:19,189 --> 00:17:17,520
in terms of magnetics

470
00:17:21,909 --> 00:17:19,199
electric fields and such so we worked

471
00:17:23,829 --> 00:17:21,919
very hard to make these extremely clean

472
00:17:25,750 --> 00:17:23,839
spacecraft and having no magnetic field

473
00:17:27,829 --> 00:17:25,760
of their own no electric charge buildup

474
00:17:29,590 --> 00:17:27,839
of their own and as this video moves on

475
00:17:31,510 --> 00:17:29,600
you can see actually here we're seeing

476
00:17:33,110 --> 00:17:31,520
when we stack them into the stack of

477
00:17:34,549 --> 00:17:33,120
four that make up the stack

478
00:17:36,470 --> 00:17:34,559
configuration that we launched that you

479
00:17:38,630 --> 00:17:36,480
saw earlier in this picture you see

480
00:17:40,390 --> 00:17:38,640
covers on the solar arrays and you see

481
00:17:41,830 --> 00:17:40,400
protective

482
00:17:43,510 --> 00:17:41,840
debris shields that we've wrapped over

483
00:17:45,270 --> 00:17:43,520
the top but essentially this is how we

484
00:17:47,430 --> 00:17:45,280
began to look and there you finally see

485
00:17:50,230 --> 00:17:47,440
a beautiful picture of the stack of four

486
00:17:52,150 --> 00:17:50,240
mms spacecraft flanked by the atlas

487
00:17:53,669 --> 00:17:52,160
fairing you can see the solar rays and

488
00:17:55,029 --> 00:17:53,679

around the top perimeter you're catching

489
00:17:56,710 --> 00:17:55,039
a glimpse of the

490
00:17:58,549 --> 00:17:56,720
some of the 25 instruments there's a

491
00:18:00,150 --> 00:17:58,559
hundred instruments total on this

492
00:18:01,830 --> 00:18:00,160
mission that we built and now we're

493
00:18:04,150 --> 00:18:01,840
finally we're seeing the actual act of

494
00:18:05,830 --> 00:18:04,160
encapsulation as they move the atlas

495
00:18:07,750 --> 00:18:05,840
fairing around us

496
00:18:09,430 --> 00:18:07,760
and then finally that that evening we

497
00:18:11,110 --> 00:18:09,440
moved it out to the launch site this is

498
00:18:13,990 --> 00:18:11,120
actually the rollout when the

499
00:18:15,990 --> 00:18:14,000
encapsulated payload moved out to the

500
00:18:17,590 --> 00:18:16,000
vertical integration facility

501
00:18:19,430 --> 00:18:17,600
for hoisting atop the atlas rocket the

502
00:18:21,190 --> 00:18:19,440
next day

503
00:18:25,029 --> 00:18:21,200
that brings us almost to where we are

504
00:18:29,590 --> 00:18:26,549
now after this i'm going to i'm going to

505
00:18:31,830 --> 00:18:29,600
hand it back to george

506
00:18:34,150 --> 00:18:31,840
all right thank you craig and we'll

507
00:18:36,150 --> 00:18:34,160
learn a little bit now about the science

508
00:18:38,230 --> 00:18:36,160
from jim burch who was the principal

509
00:18:41,029 --> 00:18:38,240
investigator for the mms mission from

510
00:18:42,549 --> 00:18:41,039
the southwest research institute jim

511
00:18:43,830 --> 00:18:42,559
well thank you george good afternoon

512
00:18:45,909 --> 00:18:43,840
everybody

513
00:18:47,990 --> 00:18:45,919

magnetic fields are continuously being

514
00:18:50,390 --> 00:18:48,000
generated and destroyed throughout the

515
00:18:52,390 --> 00:18:50,400
universe the generation parts are pretty

516
00:18:54,230 --> 00:18:52,400
well understood as a result of

517
00:18:55,350 --> 00:18:54,240
circulating currents and conducting

518
00:18:57,110 --> 00:18:55,360
fluids

519
00:18:59,029 --> 00:18:57,120
that are in the in planets are

520
00:19:00,870 --> 00:18:59,039
conducting gases in the outer parts of

521
00:19:02,710 --> 00:19:00,880
the sun and stars

522
00:19:05,350 --> 00:19:02,720
this magnetic field generation is known

523
00:19:08,310 --> 00:19:05,360
as dynamo action the destruction part

524
00:19:09,990 --> 00:19:08,320
work results from magnetic reconnection

525
00:19:13,029 --> 00:19:10,000
which occurs when magnetic fields and

526
00:19:14,950 --> 00:19:13,039
adjacent regions of space interconnect

527
00:19:17,270 --> 00:19:14,960
in the process magnetic energy is

528
00:19:19,750 --> 00:19:17,280
destroyed and heat and kinetic energy

529
00:19:22,070 --> 00:19:19,760
are released but exactly how magnetic

530
00:19:24,470 --> 00:19:22,080
energy is destroyed in a reconnection

531
00:19:26,549 --> 00:19:24,480
event is completely unknown

532
00:19:28,549 --> 00:19:26,559
because of its explosive nature magnetic

533
00:19:31,029 --> 00:19:28,559
reconnection is often described as a

534
00:19:33,430 --> 00:19:31,039
magnetic explosion in space

535
00:19:35,990 --> 00:19:33,440
reconnection is important to us as the

536
00:19:37,909 --> 00:19:36,000
engine that drives space weather and the

537
00:19:40,789 --> 00:19:37,919
main disruptor that is frustrating our

538
00:19:43,029 --> 00:19:40,799

attempts to harness nuclear fusion with

539
00:19:44,789 --> 00:19:43,039
magnetic containment devices

540
00:19:47,350 --> 00:19:44,799
the mms mission will conduct a

541
00:19:49,669 --> 00:19:47,360
definitive experiment in space that will

542
00:19:52,230 --> 00:19:49,679
finally allow us to understand how

543
00:19:53,830 --> 00:19:52,240
magnetic reconnection works and we have

544
00:19:58,710 --> 00:19:53,840
a video that

545
00:20:02,230 --> 00:20:00,470
first you'll see a

546
00:20:03,270 --> 00:20:02,240
region surrounding a black hole at the

547
00:20:05,830 --> 00:20:03,280
center

548
00:20:07,750 --> 00:20:05,840
of our galaxy

549
00:20:09,590 --> 00:20:07,760
this is we see magnetic loops that

550
00:20:11,110 --> 00:20:09,600
reconnect at their base

551
00:20:13,510 --> 00:20:11,120
this is sometimes called loop type

552
00:20:15,750 --> 00:20:13,520
reconnection the same type of loop

553
00:20:18,630 --> 00:20:15,760
reconnection occurs on the sun as we see

554
00:20:19,750 --> 00:20:18,640
here the magnetic fields on the sun

555
00:20:21,990 --> 00:20:19,760
form these

556
00:20:23,669 --> 00:20:22,000
very dynamic arcades and loops and the

557
00:20:24,789 --> 00:20:23,679
energy stored in these structures can

558
00:20:26,710 --> 00:20:24,799
release

559
00:20:28,870 --> 00:20:26,720
creating explosive solar flares and

560
00:20:30,630 --> 00:20:28,880
coronal mass ejections

561
00:20:32,710 --> 00:20:30,640
as we see here

562
00:20:35,190 --> 00:20:32,720
this reconnection was first proposed in

563
00:20:37,110 --> 00:20:35,200

1948 by a graduate student who noticed

564
00:20:39,510 --> 00:20:37,120
that when sunspots with the same

565
00:20:41,190 --> 00:20:39,520
magnetic polarity came together nothing

566
00:20:43,350 --> 00:20:41,200
happened but when the two sunspots had

567
00:20:45,430 --> 00:20:43,360
opposite polarity solar flares would

568
00:20:47,510 --> 00:20:45,440
result now here we see what happens when

569
00:20:49,510 --> 00:20:47,520
the coronal mass ejection reaches the

570
00:20:52,070 --> 00:20:49,520
earth you have magnetic reconnection

571
00:20:54,390 --> 00:20:52,080
happening both on the day side and the

572
00:20:55,830 --> 00:20:54,400
nice side of the earth as we see here

573
00:20:56,950 --> 00:20:55,840
and this creates the

574
00:20:59,590 --> 00:20:56,960
aurora

575
00:21:01,990 --> 00:20:59,600
lights in the upper atmosphere

576
00:21:03,669 --> 00:21:02,000
but this also causes

577
00:21:06,230 --> 00:21:03,679
charged particles to be accelerated to

578
00:21:08,630 --> 00:21:06,240
very high energies creating a hazard to

579
00:21:12,230 --> 00:21:08,640
space travelers in spacecraft and even

580
00:21:14,390 --> 00:21:12,240
disrupting ground-based power grids

581
00:21:16,470 --> 00:21:14,400
next slide

582
00:21:19,590 --> 00:21:16,480
a fundamental question is why and how

583
00:21:22,230 --> 00:21:19,600
does magnetic reconnection take place

584
00:21:24,710 --> 00:21:22,240
the answer is in one sense simple but in

585
00:21:27,110 --> 00:21:24,720
another sense complex and mysterious the

586
00:21:28,950 --> 00:21:27,120
simple part is that adjacent magnetic

587
00:21:30,630 --> 00:21:28,960
fields pointing in opposite directions

588
00:21:31,669 --> 00:21:30,640

at the top part and bottom part of that

589
00:21:33,990 --> 00:21:31,679
figure

590
00:21:36,149 --> 00:21:34,000
tend to annihilate each other releasing

591
00:21:38,390 --> 00:21:36,159
their magnetic energy heating charged

592
00:21:40,470 --> 00:21:38,400
particles in the surrounding environment

593
00:21:42,830 --> 00:21:40,480
in this process some magnetic fields are

594
00:21:45,830 --> 00:21:42,840
torn apart and reattached to their

595
00:21:48,310 --> 00:21:45,840
neighbors the mysterious part is what

596
00:21:49,190 --> 00:21:48,320
goes inside that box labeled diffusion

597
00:21:51,029 --> 00:21:49,200
region

598
00:21:53,430 --> 00:21:51,039
with mms we will be able to probe the

599
00:21:55,110 --> 00:21:53,440
diffusion region for the first time

600
00:21:58,149 --> 00:21:55,120
with measurements down to the smallest

601
00:22:00,950 --> 00:21:58,159
scale of the plasma the electron scale

602
00:22:03,110 --> 00:22:00,960
to solve this mystery

603
00:22:05,190 --> 00:22:03,120
now the next video

604
00:22:06,470 --> 00:22:05,200
shows the targets of our emission

605
00:22:08,870 --> 00:22:06,480
here's this diagram of the earth's

606
00:22:11,029 --> 00:22:08,880
magnetosphere the solar wind coming in

607
00:22:13,110 --> 00:22:11,039
from the left there are two boxes there

608
00:22:15,510 --> 00:22:13,120
that's where reconnection occurs

609
00:22:17,990 --> 00:22:15,520
inside these boxes the phenomenon we

610
00:22:19,270 --> 00:22:18,000
want to study exists this is a computer

611
00:22:21,029 --> 00:22:19,280
simulation

612
00:22:22,549 --> 00:22:21,039
this particular plot is of electron

613
00:22:23,510 --> 00:22:22,559

currents and you can see the dynamic

614
00:22:25,830 --> 00:22:23,520
nature

615
00:22:27,510 --> 00:22:25,840
why we need four spacecraft to probe

616
00:22:30,070 --> 00:22:27,520
particles and electric and magnetic

617
00:22:31,510 --> 00:22:30,080
fields to much higher sensitivity and

618
00:22:32,470 --> 00:22:31,520
resolution than have ever been done

619
00:22:35,590 --> 00:22:32,480
before

620
00:22:38,549 --> 00:22:35,600
to work this out

621
00:22:39,909 --> 00:22:38,559
the next slide shows how we access these

622
00:22:43,750 --> 00:22:39,919
two

623
00:22:45,430 --> 00:22:43,760
regions of interest the next video

624
00:22:47,350 --> 00:22:45,440
is our orbit in red

625
00:22:49,350 --> 00:22:47,360
so we launch on the night side the orbit

626
00:22:50,789 --> 00:22:49,360
precesses through the day side skims the

627
00:22:52,630 --> 00:22:50,799
magnetopause

628
00:22:55,750 --> 00:22:52,640
we're varying the separation between the

629
00:22:57,430 --> 00:22:55,760
spacecraft and that tetrahedron as we go

630
00:23:00,390 --> 00:22:57,440
the second time we pass through the

631
00:23:03,190 --> 00:23:00,400
magnetopause here we hold at the optimum

632
00:23:04,310 --> 00:23:03,200
separation somewhere between 10 and 160

633
00:23:06,390 --> 00:23:04,320
kilometers

634
00:23:08,230 --> 00:23:06,400
now we double our apogee

635
00:23:09,909 --> 00:23:08,240
sweep through the night side adjusting

636
00:23:14,149 --> 00:23:09,919
our separation between spacecraft

637
00:23:16,070 --> 00:23:14,159
between 10 and 400 kilometers

638
00:23:17,750 --> 00:23:16,080

so once we've done this after this two

639
00:23:19,750 --> 00:23:17,760
years we will have performed the

640
00:23:21,029 --> 00:23:19,760
definitive experiment on magnetic

641
00:23:23,110 --> 00:23:21,039
reconnection

642
00:23:25,350 --> 00:23:23,120
we have to make particle measurements

643
00:23:26,549 --> 00:23:25,360
100 times faster than the previous

644
00:23:28,549 --> 00:23:26,559
record

645
00:23:30,070 --> 00:23:28,559
because that's the electron scale

646
00:23:32,870 --> 00:23:30,080
previous missions have only been able to

647
00:23:35,029 --> 00:23:32,880
study the ion scale or the fluid scale

648
00:23:36,630 --> 00:23:35,039
and so the previous missions have only

649
00:23:39,510 --> 00:23:36,640
been able to know what happens outside

650
00:23:41,350 --> 00:23:39,520
that box not what happens inside it and

651
00:23:42,470 --> 00:23:41,360
even the computer simulations are just

652
00:23:44,950 --> 00:23:42,480
guides

653
00:23:48,390 --> 00:23:44,960
because as we know the proton

654
00:23:50,549 --> 00:23:48,400
mass is 1836 times the electron mass the

655
00:23:53,270 --> 00:23:50,559
largest computers we have can only

656
00:23:54,630 --> 00:23:53,280
handle a ratio of 100.

657
00:23:56,390 --> 00:23:54,640
and it would be a long time before

658
00:23:59,029 --> 00:23:56,400
computers big enough to do this we'll be

659
00:24:00,870 --> 00:23:59,039
able to so mms is the only way we can

660
00:24:02,230 --> 00:24:00,880
solve this mystery and we look forward

661
00:24:04,630 --> 00:24:02,240
to doing it

662
00:24:06,630 --> 00:24:04,640
thank you george thank you jim

663
00:24:08,870 --> 00:24:06,640

now look at the weather forecast for

664
00:24:11,430 --> 00:24:08,880
thursday night from clay flynn the

665
00:24:13,029 --> 00:24:11,440
launch weather officer from the 45th

666
00:24:14,549 --> 00:24:13,039
weather squadron department of the air

667
00:24:16,230 --> 00:24:14,559
force clay

668
00:24:18,549 --> 00:24:16,240
thank you very much george if you could

669
00:24:20,789 --> 00:24:18,559
bring up the satellite picture please

670
00:24:22,390 --> 00:24:20,799
if you look out into the western gulf of

671
00:24:25,029 --> 00:24:22,400
mexico you'll note quite a bit of cloud

672
00:24:27,190 --> 00:24:25,039
cover and the cloud cover extends into

673
00:24:28,710 --> 00:24:27,200
the southeast states that's associated

674
00:24:30,470 --> 00:24:28,720
really with a lower pressure in the

675
00:24:32,149 --> 00:24:30,480
western gulf that will slowly migrate to

676
00:24:34,230 --> 00:24:32,159
the east as well as associated frontal

677
00:24:35,669 --> 00:24:34,240
boundaries there in the southeast states

678
00:24:37,190 --> 00:24:35,679
looking off to the east you'll note that

679
00:24:38,630 --> 00:24:37,200
we have pretty fair weather not many

680
00:24:40,789 --> 00:24:38,640
clouds out to the east of the florida

681
00:24:42,390 --> 00:24:40,799
peninsula and that's associated with an

682
00:24:44,470 --> 00:24:42,400
upper level ridge that will tend to

683
00:24:46,549 --> 00:24:44,480
that eastward motion of that

684
00:24:48,630 --> 00:24:46,559
system that you see in the western gulf

685
00:24:49,990 --> 00:24:48,640
so as we as we approach launch day on

686
00:24:52,390 --> 00:24:50,000
thursday we should see the system

687
00:24:53,990 --> 00:24:52,400
migrate slowly towards the east and be

688
00:24:55,750 --> 00:24:54,000

steered to the north so that ridge out

689
00:24:57,590 --> 00:24:55,760
to the east will actually tend to

690
00:24:58,950 --> 00:24:57,600
deflect that that system that you see

691
00:25:01,029 --> 00:24:58,960
the quite a bit the

692
00:25:02,630 --> 00:25:01,039
extensive cloud cover that you see there

693
00:25:04,230 --> 00:25:02,640
to the north and east so on launch they

694
00:25:06,710 --> 00:25:04,240
would expect to see the bulk of that to

695
00:25:08,549 --> 00:25:06,720
the north and to the west

696
00:25:10,870 --> 00:25:08,559
looking into mlp role tomorrow we'll

697
00:25:12,549 --> 00:25:10,880
have southerly winds we'll likely have

698
00:25:14,149 --> 00:25:12,559
some coastal showers

699
00:25:15,909 --> 00:25:14,159
the winds are from the south southeast

700
00:25:18,310 --> 00:25:15,919
we should be gusting

701
00:25:19,909 --> 00:25:18,320
in the mid teens at about 230 feet about

702
00:25:21,750 --> 00:25:19,919
the time we roll tomorrow with a few

703
00:25:23,830 --> 00:25:21,760
isolated coastal showers not looking

704
00:25:26,070 --> 00:25:23,840
like it would pose any concern really

705
00:25:28,149 --> 00:25:26,080
for a roll to pad tomorrow

706
00:25:31,190 --> 00:25:28,159
as we and again the system stays out to

707
00:25:33,590 --> 00:25:31,200
the west and to the north uh as we move

708
00:25:35,430 --> 00:25:33,600
into launch day on thursday night again

709
00:25:37,029 --> 00:25:35,440
the system would remain the system that

710
00:25:38,549 --> 00:25:37,039
you saw in the gulf would remain out to

711
00:25:40,230 --> 00:25:38,559
the north and west

712
00:25:43,110 --> 00:25:40,240
uh so the bulk of the cloud cover and

713
00:25:44,870 --> 00:25:43,120

the showers up that way however

714
00:25:46,630 --> 00:25:44,880
we do increase in moisture in the upper

715
00:25:48,870 --> 00:25:46,640
levels so that would be a potential

716
00:25:50,630 --> 00:25:48,880
concern for a thick cloud rule it looks

717
00:25:53,510 --> 00:25:50,640
like the moisture the clouds would dip

718
00:25:55,590 --> 00:25:53,520
down to near about with a minus 20. and

719
00:25:57,669 --> 00:25:55,600
if we get clouds between zero and -20

720
00:25:58,870 --> 00:25:57,679
that are have greater than 4 500 feet

721
00:26:02,149 --> 00:25:58,880
thick

722
00:26:03,590 --> 00:26:02,159
cloud rule concern so we'd have to

723
00:26:06,070 --> 00:26:03,600
monitor that that's one of the concerns

724
00:26:07,510 --> 00:26:06,080
for launch day thursday evening likewise

725
00:26:09,269 --> 00:26:07,520
in the lower levels in the lower 10 to

726
00:26:11,669 --> 00:26:09,279
12 000 feet of the atmosphere our winds

727
00:26:13,110 --> 00:26:11,679
go south southeast southeasterly and

728
00:26:14,950 --> 00:26:13,120
essentially what that aids in is

729
00:26:16,870 --> 00:26:14,960
bringing in coastal showers coastal

730
00:26:18,470 --> 00:26:16,880
showers typically are favored during the

731
00:26:20,630 --> 00:26:18,480
nocturnal hours so with a late night

732
00:26:22,630 --> 00:26:20,640
launch we start to see showers

733
00:26:24,149 --> 00:26:22,640
enhance a bit and with the southeast

734
00:26:25,110 --> 00:26:24,159
flow trying to bring those showers on

735
00:26:26,710 --> 00:26:25,120
shore

736
00:26:28,870 --> 00:26:26,720
so that would be the second second

737
00:26:30,549 --> 00:26:28,880
concern as well cumulus cloud rule so

738
00:26:32,470 --> 00:26:30,559

those are the two principal concerns for

739
00:26:34,070 --> 00:26:32,480
thursday evening thick clouds streaming

740
00:26:35,750 --> 00:26:34,080
in from the west

741
00:26:37,590 --> 00:26:35,760
and then cumulus clouds streaming in

742
00:26:38,950 --> 00:26:37,600
from the southeast so our winds are

743
00:26:40,470 --> 00:26:38,960
actually in opposite directions they're

744
00:26:42,310 --> 00:26:40,480
low-level winds from the southeast upper

745
00:26:44,390 --> 00:26:42,320
level winds from the west

746
00:26:45,909 --> 00:26:44,400
about a 30 chance of violation on

747
00:26:48,630 --> 00:26:45,919
thursday evening we'd be looking for

748
00:26:50,470 --> 00:26:48,640
scattered clouds at about 3000 feet a

749
00:26:52,789 --> 00:26:50,480
broken deck of clouds at about 25

750
00:26:54,710 --> 00:26:52,799
thousand feet and and the clouds look to

751
00:26:57,110 --> 00:26:54,720
be pretty thick above that but the base

752
00:26:58,870 --> 00:26:57,120
of those clouds about 25 000 feet right

753
00:27:01,750 --> 00:26:58,880
about where the -20 is so we'd have to

754
00:27:03,269 --> 00:27:01,760
monitor that good visibility our winds

755
00:27:04,870 --> 00:27:03,279
should be southeasterly and these are at

756
00:27:07,190 --> 00:27:04,880
a couple hundred feet gusting to about

757
00:27:08,549 --> 00:27:07,200
20 knots and that's below the liftoff

758
00:27:11,909 --> 00:27:08,559
constraint so it doesn't like winds

759
00:27:13,669 --> 00:27:11,919
would be an issue for thursday evening

760
00:27:16,149 --> 00:27:13,679
should we be on the pad for a 24 hour

761
00:27:17,590 --> 00:27:16,159
delay and some deterioration in the

762
00:27:19,430 --> 00:27:17,600
sense that we have an increasing

763
00:27:20,630 --> 00:27:19,440

moisture in the mid and upper levels

764
00:27:21,750 --> 00:27:20,640
which would tend to make a greater

765
00:27:25,750 --> 00:27:21,760
threat

766
00:27:28,310 --> 00:27:25,760
for a thick cloud rule violation so 40

767
00:27:29,990 --> 00:27:28,320
chance of violation at this time for

768
00:27:31,669 --> 00:27:30,000
an attempt on friday evening should we

769
00:27:33,430 --> 00:27:31,679
be on the pad friday evening again we'd

770
00:27:34,390 --> 00:27:33,440
be looking for a scattered at 3 thousand

771
00:27:36,149 --> 00:27:34,400
feet

772
00:27:37,750 --> 00:27:36,159
more more clouds in the mid level so a

773
00:27:39,350 --> 00:27:37,760
broken deck at about eighteen thousand

774
00:27:41,190 --> 00:27:39,360
feet and then upper level deck about

775
00:27:43,269 --> 00:27:41,200
twenty five to thirty thousand feet uh

776
00:27:45,110 --> 00:27:43,279
winds a little more south southeasterly

777
00:27:46,870 --> 00:27:45,120
gusting in the upper teens

778
00:27:48,710 --> 00:27:46,880
with a forty percent chance of violation

779
00:27:51,029 --> 00:27:48,720
again that would principally be cumulus

780
00:27:52,950 --> 00:27:51,039
cloud and thick cloud

781
00:27:55,669 --> 00:27:52,960
and that's all i have george all right

782
00:27:58,310 --> 00:27:55,679
thank you clay and we're ready now to

783
00:27:59,990 --> 00:27:58,320
take questions we'll start first with

784
00:28:01,510 --> 00:28:00,000
media here in the

785
00:28:04,149 --> 00:28:01,520
room and if we have any questions on

786
00:28:06,310 --> 00:28:04,159
social media we'll be able to take those

787
00:28:07,830 --> 00:28:06,320
as well so we'll start here with marcia

788
00:28:09,029 --> 00:28:07,840

please give your name affiliation when

789
00:28:11,029 --> 00:28:09,039
you get the mic

790
00:28:13,190 --> 00:28:11,039
marcia done associated press with two

791
00:28:15,350 --> 00:28:13,200
spacecraft questions and a big question

792
00:28:17,909 --> 00:28:15,360
probably for mr twilio dr burch you

793
00:28:19,830 --> 00:28:17,919
mentioned 10 kilometers is the closest

794
00:28:21,430 --> 00:28:19,840
you would like the spacecraft what's the

795
00:28:22,789 --> 00:28:21,440
farthest that they can be to work

796
00:28:23,750 --> 00:28:22,799
efficiently

797
00:28:25,510 --> 00:28:23,760
um

798
00:28:27,750 --> 00:28:25,520
can you do you need all four could you

799
00:28:29,669 --> 00:28:27,760
get by with three or fewer

800
00:28:31,909 --> 00:28:29,679
and what will be the practical

801
00:28:33,430 --> 00:28:31,919
applications of the knowledge gained

802
00:28:35,029 --> 00:28:33,440
from all this

803
00:28:36,870 --> 00:28:35,039
why don't i i'll start the answer and

804
00:28:39,190 --> 00:28:36,880
then and then jim burch can pick it up

805
00:28:41,669 --> 00:28:39,200
in a little more detail but um first the

806
00:28:43,350 --> 00:28:41,679
easiest one is we need four spacecraft

807
00:28:45,110 --> 00:28:43,360
because in order to get

808
00:28:47,029 --> 00:28:45,120
three dimensions we essentially need

809
00:28:48,950 --> 00:28:47,039
four points in space three will make a

810
00:28:50,710 --> 00:28:48,960
sheet of paper so that's in order to

811
00:28:52,149 --> 00:28:50,720
capture and do measurements in three

812
00:28:54,470 --> 00:28:52,159
dimensions that's why we need three it

813
00:28:56,070 --> 00:28:54,480

is true that you know

814
00:28:57,590 --> 00:28:56,080
if one were to fail late in the mission

815
00:28:59,830 --> 00:28:57,600
or something we can still do significant

816
00:29:01,990 --> 00:28:59,840
science with only three but certainly

817
00:29:04,789 --> 00:29:02,000
not meet um our main objectives so we

818
00:29:07,350 --> 00:29:04,799
need we need all four um 10 kilometers

819
00:29:08,789 --> 00:29:07,360
to almost 200 kilometers and then later

820
00:29:12,070 --> 00:29:08,799
in the second half of the mission we may

821
00:29:13,590 --> 00:29:12,080
fly as far apart as 400 kilometers um

822
00:29:15,510 --> 00:29:13,600
but because we don't understand

823
00:29:17,350 --> 00:29:15,520
magnitude connection well enough that's

824
00:29:18,630 --> 00:29:17,360
why we will actually use the first part

825
00:29:20,149 --> 00:29:18,640
of the mission and jim could talk a

826
00:29:21,669 --> 00:29:20,159
little bit more about this to to you

827
00:29:24,070 --> 00:29:21,679
know essentially optimize that

828
00:29:25,430 --> 00:29:24,080
separation distance um

829
00:29:27,510 --> 00:29:25,440
in order to and when we start seeing

830
00:29:28,149 --> 00:29:27,520
magnetic reconnection events so you want

831
00:29:30,070 --> 00:29:28,159
to

832
00:29:32,630 --> 00:29:30,080
elaborate a little bit right well 10

833
00:29:34,389 --> 00:29:32,640
kilometers is the electron scale and the

834
00:29:35,909 --> 00:29:34,399
plasma scale on the when the densities

835
00:29:37,830 --> 00:29:35,919
are high like on the day side of the

836
00:29:39,430 --> 00:29:37,840
earth we go the nice side the densities

837
00:29:40,630 --> 00:29:39,440
are lower we can have a larger

838
00:29:43,110 --> 00:29:40,640

separation

839
00:29:45,350 --> 00:29:43,120
we want to go out to the 400 to to also

840
00:29:47,669 --> 00:29:45,360
get the ion scale you know that's been

841
00:29:49,909 --> 00:29:47,679
done before like for the european by the

842
00:29:51,510 --> 00:29:49,919
european cluster mission they we want to

843
00:29:54,310 --> 00:29:51,520
connect the two we want to connect the

844
00:29:56,870 --> 00:29:54,320
ion scale to the electron scale physics

845
00:29:58,470 --> 00:29:56,880
now as far as practical applications uh

846
00:30:00,950 --> 00:29:58,480
you know this mission is part of the

847
00:30:03,590 --> 00:30:00,960
solar terrestrial probes program there's

848
00:30:05,510 --> 00:30:03,600
another program in nasa heliophysics

849
00:30:07,669 --> 00:30:05,520
directors here jeff newmark and that's

850
00:30:09,990 --> 00:30:07,679
called living with the star and that's

851
00:30:11,990 --> 00:30:10,000
more of the

852
00:30:15,190 --> 00:30:12,000
applied it's not really applied but it's

853
00:30:17,510 --> 00:30:15,200
research that's more of

854
00:30:19,190 --> 00:30:17,520
say for example forecasting space

855
00:30:20,950 --> 00:30:19,200
weather would be a goal of living with

856
00:30:22,630 --> 00:30:20,960
the star it wouldn't be a goal of solar

857
00:30:24,710 --> 00:30:22,640
terrestrial probes the goal there is

858
00:30:28,789 --> 00:30:24,720
fundamental research

859
00:30:30,549 --> 00:30:28,799
since i mentioned earlier the magnetic

860
00:30:32,870 --> 00:30:30,559
reconnection is the engine that drives

861
00:30:35,269 --> 00:30:32,880
space weather so it causes the solar

862
00:30:37,669 --> 00:30:35,279
flares the coronal mass ejections the

863
00:30:39,909 --> 00:30:37,679

geomagnetic storms the aurora the high

864
00:30:41,990 --> 00:30:39,919
energy particles both at the earth and

865
00:30:43,269 --> 00:30:42,000
the ones produced from the sun all of

866
00:30:44,789 --> 00:30:43,279
that is produced by magnetic

867
00:30:47,350 --> 00:30:44,799
reconnection so everything to do with

868
00:30:49,909 --> 00:30:47,360
space weather starts with reconnection

869
00:30:51,510 --> 00:30:49,919
so i would say if we can understand it

870
00:30:53,590 --> 00:30:51,520
and our goal isn't to predict space

871
00:30:54,470 --> 00:30:53,600
weather but we would understand it much

872
00:30:56,470 --> 00:30:54,480
better

873
00:30:58,950 --> 00:30:56,480
and now and i mentioned only briefly

874
00:31:00,870 --> 00:30:58,960
about tocomax the magnetic confinement

875
00:31:02,389 --> 00:31:00,880
fusion program

876
00:31:04,630 --> 00:31:02,399
and that's been a program that's been

877
00:31:06,789 --> 00:31:04,640
frustrating for the last couple of

878
00:31:09,110 --> 00:31:06,799
decades because you can find a plasma in

879
00:31:10,470 --> 00:31:09,120
a doughnut-shaped magnetic field build

880
00:31:12,870 --> 00:31:10,480
up the temperature to start getting

881
00:31:15,269 --> 00:31:12,880
fusion and it always temperatures always

882
00:31:17,669 --> 00:31:15,279
drop they call these sawtooth crashes

883
00:31:20,389 --> 00:31:17,679
what causes those magnetic reconnections

884
00:31:22,149 --> 00:31:20,399
so as we learn how reconnection works

885
00:31:23,909 --> 00:31:22,159
and we work closely with the people at

886
00:31:26,950 --> 00:31:23,919
princeton plasma physics lab who do

887
00:31:28,950 --> 00:31:26,960
these experiments uh we think it you

888
00:31:32,789 --> 00:31:28,960

know it could enlighten them on how best

889
00:31:34,470 --> 00:31:32,799
to to do better

890
00:31:37,190 --> 00:31:34,480
all right ken

891
00:31:38,710 --> 00:31:37,200
hi excuse me hi ken kramer for america's

892
00:31:41,269 --> 00:31:38,720
space and universe today i have two

893
00:31:43,269 --> 00:31:41,279
questions uh for craig and jim jim burch

894
00:31:45,190 --> 00:31:43,279
for craig you've talked a couple of

895
00:31:46,549 --> 00:31:45,200
times about um

896
00:31:48,950 --> 00:31:46,559
the magnetic environment for these

897
00:31:51,669 --> 00:31:48,960
spacecraft is incredibly low i was

898
00:31:52,470 --> 00:31:51,679
wondering if this has application in

899
00:31:54,870 --> 00:31:52,480
other

900
00:31:57,430 --> 00:31:54,880
science experiments and payloads that

901
00:31:59,029 --> 00:31:57,440
you guys can apply in the future and for

902
00:32:00,870 --> 00:31:59,039
jim birch i guess you've been thinking

903
00:32:03,190 --> 00:32:00,880
about this for a long time your goal

904
00:32:05,029 --> 00:32:03,200
definitely is to solve this problem so

905
00:32:08,149 --> 00:32:05,039
can you talk a little bit of a

906
00:32:10,310 --> 00:32:08,159
reconnection of uh of how how did you

907
00:32:12,389 --> 00:32:10,320
why did you chose the instruments that

908
00:32:13,669 --> 00:32:12,399
you that you chose for this experiment

909
00:32:16,230 --> 00:32:13,679
maybe you can give us a little preview

910
00:32:18,470 --> 00:32:16,240
of the science briefing please thanks

911
00:32:20,149 --> 00:32:18,480
mission we needed very advanced

912
00:32:21,509 --> 00:32:20,159
instruments as i mentioned the speed of

913
00:32:23,350 --> 00:32:21,519

measurement of the particles factor of

914
00:32:24,549 --> 00:32:23,360
100 times faster than had been done

915
00:32:26,470 --> 00:32:24,559
before

916
00:32:28,549 --> 00:32:26,480
and so whenever you form a team like

917
00:32:30,470 --> 00:32:28,559
this of course you you want to get the

918
00:32:32,870 --> 00:32:30,480
best groups that have the best

919
00:32:34,310 --> 00:32:32,880
instruments have experience flying these

920
00:32:36,230 --> 00:32:34,320
before

921
00:32:38,310 --> 00:32:36,240
and of course there are competing teams

922
00:32:39,669 --> 00:32:38,320
and so you you know you lose some people

923
00:32:42,149 --> 00:32:39,679
and you gain some different people so

924
00:32:44,549 --> 00:32:42,159
it's a very interesting process that you

925
00:32:46,630 --> 00:32:44,559
go through and then you compete

926
00:32:48,950 --> 00:32:46,640
but all these instruments were

927
00:32:50,389 --> 00:32:48,960
beyond the state of the art and as we

928
00:32:52,230 --> 00:32:50,399
got into it we had to take some

929
00:32:53,509 --> 00:32:52,240
different approaches

930
00:32:55,029 --> 00:32:53,519
craig was talking about university at

931
00:32:56,870 --> 00:32:55,039
new hampshire they took on a much bigger

932
00:32:59,350 --> 00:32:56,880
job than we had planned

933
00:33:01,669 --> 00:32:59,360
in the beginning they designed and built

934
00:33:02,789 --> 00:33:01,679
all of those spin plane double probes

935
00:33:05,350 --> 00:33:02,799
and uh

936
00:33:06,870 --> 00:33:05,360
this very impressive activity going from

937
00:33:09,269 --> 00:33:06,880
you know not having done it before to

938
00:33:10,470 --> 00:33:09,279

doing the most advanced system

939
00:33:12,230 --> 00:33:10,480
we've seen

940
00:33:13,190 --> 00:33:12,240
also i wanted to mention an instrument

941
00:33:18,870 --> 00:33:13,200
that

942
00:33:20,310 --> 00:33:18,880
much but it's a energy it's a

943
00:33:22,789 --> 00:33:20,320
mass spectrometer an ion mass

944
00:33:24,310 --> 00:33:22,799
spectrometer working in kev range all

945
00:33:27,190 --> 00:33:24,320
the previous missions have not been able

946
00:33:28,870 --> 00:33:27,200
to measure heavy ions like oxygen from

947
00:33:31,110 --> 00:33:28,880
the ionosphere as they flow into the

948
00:33:32,950 --> 00:33:31,120
reconnection region because of

949
00:33:34,950 --> 00:33:32,960
contamination by solar wind protons

950
00:33:37,669 --> 00:33:34,960
which have very high fluxes so you

951
00:33:40,630 --> 00:33:37,679
needed a way to turn those fluxes down

952
00:33:42,310 --> 00:33:40,640
but not affect the oxygen fluxes

953
00:33:43,909 --> 00:33:42,320
that never had been done before and we

954
00:33:45,909 --> 00:33:43,919
have an instrument called the hot plasma

955
00:33:47,269 --> 00:33:45,919
composition analyzer

956
00:33:49,269 --> 00:33:47,279
that does that

957
00:33:50,710 --> 00:33:49,279
and so if there for example if oxygen

958
00:33:52,710 --> 00:33:50,720
coming in there cuts down the

959
00:33:54,789 --> 00:33:52,720
reconnection rate that might help the

960
00:33:56,789 --> 00:33:54,799
people in the laboratory

961
00:33:57,830 --> 00:33:56,799
as well we don't know it could go the

962
00:34:00,070 --> 00:33:57,840
other way

963
00:34:01,430 --> 00:34:00,080

but we'll know

964
00:34:03,509 --> 00:34:01,440
and i can follow up on your first part

965
00:34:05,190 --> 00:34:03,519
of your question um

966
00:34:06,950 --> 00:34:05,200
and if in fact one of the reasons this

967
00:34:08,389 --> 00:34:06,960
mission was built at goddard um we did

968
00:34:10,550 --> 00:34:08,399
this in-house was because of the

969
00:34:12,470 --> 00:34:10,560
challenges of making this

970
00:34:13,990 --> 00:34:12,480
so magnetically and electrostatically

971
00:34:15,270 --> 00:34:14,000
clean um

972
00:34:16,950 --> 00:34:15,280
and this is applicable in almost any

973
00:34:18,869 --> 00:34:16,960
mission that that follows on that would

974
00:34:21,589 --> 00:34:18,879
have magnetometers or electric field

975
00:34:23,510 --> 00:34:21,599
sensors and indeed

976
00:34:26,389 --> 00:34:23,520
we are between a hundred in some cases

977
00:34:28,470 --> 00:34:26,399
to to a thousand times

978
00:34:31,030 --> 00:34:28,480
cleaner or have lower residual magnetic

979
00:34:32,550 --> 00:34:31,040
fields and lower levels of of actual

980
00:34:34,389 --> 00:34:32,560
charge buildup on our spacecraft than a

981
00:34:35,750 --> 00:34:34,399
typical spacecraft and essentially we

982
00:34:37,589 --> 00:34:35,760
have now set the standard at least at

983
00:34:39,909 --> 00:34:37,599
goddard space flight center for for not

984
00:34:41,909 --> 00:34:39,919
only what you one could achieve but you

985
00:34:44,069 --> 00:34:41,919
know the practical methodologies of how

986
00:34:45,909 --> 00:34:44,079
do you cancel out all of your magnetic

987
00:34:47,270 --> 00:34:45,919
fields from all of your electrical

988
00:34:49,109 --> 00:34:47,280

equipment that has running currents how

989
00:34:50,869 --> 00:34:49,119
do you control

990
00:34:52,149 --> 00:34:50,879
all of your construction materials and

991
00:34:53,750 --> 00:34:52,159
all of your surface treatments so you

992
00:34:55,510 --> 00:34:53,760
don't build up we only build up four

993
00:34:57,349 --> 00:34:55,520
volts across the whole spacecraft and a

994
00:34:58,630 --> 00:34:57,359
typical spacecraft that doesn't

995
00:35:00,310 --> 00:34:58,640
that doesn't concern itself with this

996
00:35:03,030 --> 00:35:00,320
and sometimes it doesn't matter you know

997
00:35:04,790 --> 00:35:03,040
can have 10 to 20 kilovolts of charge

998
00:35:06,870 --> 00:35:04,800
build up on its surface indeed if you

999
00:35:09,510 --> 00:35:06,880
had gone up on the launch you know as as

1000
00:35:10,710 --> 00:35:09,520
ula uh integrated the rocket and put us

1001
00:35:13,510 --> 00:35:10,720
on you would have found we essentially

1002
00:35:15,510 --> 00:35:13,520
had magnetic police at every station and

1003
00:35:17,589 --> 00:35:15,520
we had people there with magnetometers

1004
00:35:19,589 --> 00:35:17,599
and sensors and no tool

1005
00:35:22,150 --> 00:35:19,599
gets close to the mms spacecraft that's

1006
00:35:23,750 --> 00:35:22,160
not either magnetic non-magnetic or gets

1007
00:35:25,510 --> 00:35:23,760
degaussed since it's been going for

1008
00:35:26,390 --> 00:35:25,520
years we de-gauss everything

1009
00:35:37,550 --> 00:35:26,400
we

1010
00:35:41,030 --> 00:35:39,109
calicofieldwithspace.com i have a

1011
00:35:42,230 --> 00:35:41,040
question for clay and then one for craig

1012
00:35:44,790 --> 00:35:42,240
and jim

1013
00:35:46,550 --> 00:35:44,800

can you estimate how visible

1014
00:35:48,069 --> 00:35:46,560
the rocket will be what the visibility

1015
00:35:50,790 --> 00:35:48,079
conditions will be on thursday night how

1016
00:35:52,310 --> 00:35:50,800
far away people might be able to see it

1017
00:35:55,030 --> 00:35:52,320
and then craig and jim just wondering if

1018
00:35:57,750 --> 00:35:55,040
there's any kind of a limit on when

1019
00:35:59,430 --> 00:35:57,760
mms needs to be launched to get into its

1020
00:36:02,550 --> 00:35:59,440
ideal orbit any kind of a window that

1021
00:36:06,390 --> 00:36:04,630
i don't expect a lot of low clouds so

1022
00:36:07,829 --> 00:36:06,400
really i would expect typically what you

1023
00:36:09,589 --> 00:36:07,839
could see on a typical launch so

1024
00:36:10,550 --> 00:36:09,599
certainly from orlando or even west of

1025
00:36:12,310 --> 00:36:10,560
there

1026
00:36:13,670 --> 00:36:12,320
i think we'd probably lose visibility

1027
00:36:15,430 --> 00:36:13,680
although you'll see the light go through

1028
00:36:17,990 --> 00:36:15,440
the clouds but you know once it gets up

1029
00:36:19,990 --> 00:36:18,000
to about 25 000 feet or so i think we'll

1030
00:36:21,270 --> 00:36:20,000
start to see the uh lose the visibility

1031
00:36:22,950 --> 00:36:21,280
of the cloud so you probably not might

1032
00:36:24,390 --> 00:36:22,960
not see the srv separate which is

1033
00:36:26,870 --> 00:36:24,400
typically pretty good this are pretty

1034
00:36:28,790 --> 00:36:26,880
fun to watch but generally speaking i

1035
00:36:30,790 --> 00:36:28,800
think we'll we'll lose it after about 25

1036
00:36:32,550 --> 00:36:30,800
000 feet because i think we will have

1037
00:36:36,150 --> 00:36:32,560
broken and then maybe even broken to

1038
00:36:37,349 --> 00:36:36,160

overcast clouds as it goes downrange

1039
00:36:39,670 --> 00:36:37,359
to answer questions about the launch

1040
00:36:40,870 --> 00:36:39,680
window

1041
00:36:43,270 --> 00:36:40,880
we can launch

1042
00:36:44,310 --> 00:36:43,280
any day we have about a 30-minute window

1043
00:36:45,910 --> 00:36:44,320
and it varies just a little bit

1044
00:36:47,750 --> 00:36:45,920
depending on as we move through the

1045
00:36:49,670 --> 00:36:47,760
calendar it gets a teeny bit shorter as

1046
00:36:51,910 --> 00:36:49,680
days move on but we can launch any day

1047
00:36:54,710 --> 00:36:51,920
of the year essentially so so from a

1048
00:36:56,230 --> 00:36:54,720
spacecraft achieving our orbits and such

1049
00:36:57,910 --> 00:36:56,240
we don't have a constraint we just have

1050
00:36:58,790 --> 00:36:57,920
a 30-minute window each day that

1051
00:37:01,270 --> 00:36:58,800
throughout the calendar year and we

1052
00:37:02,310 --> 00:37:01,280
actually worked quite hard to establish

1053
00:37:03,349 --> 00:37:02,320
it was a lot of work for the science

1054
00:37:05,190 --> 00:37:03,359
team to make sure that we could

1055
00:37:06,630 --> 00:37:05,200
fine-tune our requirements

1056
00:37:08,710 --> 00:37:06,640
earlier in the program we had some

1057
00:37:11,030 --> 00:37:08,720
preferred seasons but as it got

1058
00:37:13,270 --> 00:37:11,040
difficult to to make sure we secured the

1059
00:37:16,150 --> 00:37:13,280
earliest launch date we we refined that

1060
00:37:18,550 --> 00:37:16,160
so that we essentially opened mms mms up

1061
00:37:20,230 --> 00:37:18,560
to launch uh any day of the year

1062
00:37:21,750 --> 00:37:20,240
i we're going to launch

1063
00:37:24,550 --> 00:37:21,760

in two days or three days but we could

1064
00:37:25,589 --> 00:37:24,560
go any day of the year

1065
00:37:29,670 --> 00:37:25,599
daryl

1066
00:37:31,510 --> 00:37:29,680
uh for jim

1067
00:37:32,710 --> 00:37:31,520
once you're able to solve the magnetic

1068
00:37:35,589 --> 00:37:32,720
reconnection do you know where that

1069
00:37:37,109 --> 00:37:35,599
takes you from there

1070
00:37:38,710 --> 00:37:37,119
well you know we think we know how to

1071
00:37:40,870 --> 00:37:38,720
solve this problem because we're going

1072
00:37:42,630 --> 00:37:40,880
to measure down at the smallest scale at

1073
00:37:43,510 --> 00:37:42,640
the highest time resolution that's

1074
00:37:45,430 --> 00:37:43,520
needed

1075
00:37:46,710 --> 00:37:45,440
to get down to this electron scale so we

1076
00:37:48,630 --> 00:37:46,720
think we'll solve it there won't be a

1077
00:37:50,069 --> 00:37:48,640
need for another mission but however

1078
00:37:51,910 --> 00:37:50,079
every mission i've been involved in

1079
00:37:53,670 --> 00:37:51,920
there always been surprises

1080
00:37:54,790 --> 00:37:53,680
new mysteries new things to come up that

1081
00:37:57,430 --> 00:37:54,800
you want to

1082
00:37:59,510 --> 00:37:57,440
study or need to study so i can't

1083
00:38:02,870 --> 00:37:59,520
count that out but we think we have an

1084
00:38:05,030 --> 00:38:02,880
optimum experiment on reconnection

1085
00:38:06,950 --> 00:38:05,040
and its application to nuclear fusion

1086
00:38:09,510 --> 00:38:06,960
you touched on that briefly can you

1087
00:38:11,030 --> 00:38:09,520
explain where they would take that data

1088
00:38:13,349 --> 00:38:11,040

well they're very interested in our

1089
00:38:15,109 --> 00:38:13,359
mission because in a plasma tank you can

1090
00:38:17,589 --> 00:38:15,119
only make very rudimentary measurements

1091
00:38:18,950 --> 00:38:17,599
like temperature density that's about it

1092
00:38:20,630 --> 00:38:18,960
because it's pretty small you can't fit

1093
00:38:22,790 --> 00:38:20,640
this whole spacecraft in one of those

1094
00:38:24,630 --> 00:38:22,800
tanks so

1095
00:38:26,550 --> 00:38:24,640
they'd like to know what's going on in

1096
00:38:27,670 --> 00:38:26,560
there causing reconnection that's

1097
00:38:29,910 --> 00:38:27,680
defeating

1098
00:38:32,069 --> 00:38:29,920
their confinement of plasma up to these

1099
00:38:34,550 --> 00:38:32,079
high temperatures 100 million degrees in

1100
00:38:36,950 --> 00:38:34,560
the electrons but they can't do it but

1101
00:38:38,630 --> 00:38:36,960
we can do it in space so

1102
00:38:44,390 --> 00:38:38,640
they're just very interested in scaling

1103
00:38:47,510 --> 00:38:46,150
all right we have a question right down

1104
00:38:50,630 --> 00:38:47,520
here

1105
00:38:53,430 --> 00:38:50,640
yes uh historical imagery mark gotch

1106
00:38:57,670 --> 00:38:53,440
from canada can you tell me this being

1107
00:39:00,630 --> 00:38:57,680
the last of these series of missions uh

1108
00:39:02,710 --> 00:39:00,640
absorbing this important data of the

1109
00:39:05,510 --> 00:39:02,720
magnetosphere

1110
00:39:07,670 --> 00:39:05,520
the fold out 40-foot booms

1111
00:39:09,910 --> 00:39:07,680
would these be the same type of booms

1112
00:39:11,589 --> 00:39:09,920
that were previously on the other

1113
00:39:12,790 --> 00:39:11,599

satellites launched

1114
00:39:14,390 --> 00:39:12,800
and

1115
00:39:16,710 --> 00:39:14,400
would this enhance

1116
00:39:19,109 --> 00:39:16,720
what you're going to gather in terms of

1117
00:39:21,030 --> 00:39:19,119
this information on this launch yes

1118
00:39:24,470 --> 00:39:21,040
these actually well not 40 feet each one

1119
00:39:25,990 --> 00:39:24,480
is 60 meters out so

1120
00:39:27,910 --> 00:39:26,000
okay so that's more like 200 feet in

1121
00:39:28,790 --> 00:39:27,920
each direction and but that's not a

1122
00:39:30,150 --> 00:39:28,800
record

1123
00:39:32,550 --> 00:39:30,160
and i was p i have another mission

1124
00:39:35,190 --> 00:39:32,560
called image where we had 500 foot

1125
00:39:37,589 --> 00:39:35,200
antennas like that and we've well you

1126
00:39:39,190 --> 00:39:37,599
know as tall as a new new empire state

1127
00:39:40,950 --> 00:39:39,200
building i believe you took both

1128
00:39:42,150 --> 00:39:40,960
directions so

1129
00:39:43,910 --> 00:39:42,160
we were doing something different we

1130
00:39:45,910 --> 00:39:43,920
were transmitting waves from those

1131
00:39:48,870 --> 00:39:45,920
antennas and looking for reflections for

1132
00:39:51,030 --> 00:39:48,880
what we need to do here the 60 meters is

1133
00:39:52,950 --> 00:39:51,040
is good i think it's typical it may not

1134
00:39:54,950 --> 00:39:52,960
be the longest it's it's longer than

1135
00:39:57,109 --> 00:39:54,960
what they have on cluster but the main

1136
00:39:58,870 --> 00:39:57,119
thing is we have that third axis

1137
00:40:00,470 --> 00:39:58,880
the cluster mission only had two axis

1138
00:40:01,750 --> 00:40:00,480

electric fields

1139
00:40:03,670 --> 00:40:01,760
and the only thing they could do is

1140
00:40:05,270 --> 00:40:03,680
assume the electric field along the

1141
00:40:07,430 --> 00:40:05,280
magnetic field that one component was

1142
00:40:08,310 --> 00:40:07,440
zero because theoretically it should be

1143
00:40:10,390 --> 00:40:08,320
zero

1144
00:40:12,390 --> 00:40:10,400
but in a reconnection region it's not

1145
00:40:14,069 --> 00:40:12,400
zero that's exactly what happens you get

1146
00:40:15,430 --> 00:40:14,079
an electric field component along the

1147
00:40:18,150 --> 00:40:15,440
magnetic field

1148
00:40:19,990 --> 00:40:18,160
so to do a 2d electric field measurement

1149
00:40:21,270 --> 00:40:20,000
for a reconnection it's not going to

1150
00:40:24,310 --> 00:40:21,280
tell you anything

1151
00:40:27,190 --> 00:40:24,320
and so we do have these three and as far

1152
00:40:30,069 --> 00:40:27,200
as the the actual mechanism i think it's

1153
00:40:32,230 --> 00:40:30,079
it's uh a very advanced mechanism that

1154
00:40:34,150 --> 00:40:32,240
has been developed by unh in fact the

1155
00:40:35,270 --> 00:40:34,160
the pi for that sitting in the back ray

1156
00:40:38,310 --> 00:40:35,280
tarbert

1157
00:40:43,190 --> 00:40:38,320
and uh a lot of confidence in it but

1158
00:40:46,470 --> 00:40:44,390
all right we have a question here in the

1159
00:40:47,670 --> 00:40:46,480
front cali mcpherson university of new

1160
00:40:49,990 --> 00:40:47,680
hampshire

1161
00:40:52,630 --> 00:40:50,000
in your opinion will the success of mms

1162
00:40:54,390 --> 00:40:52,640
lead to any greater roles for any of the

1163
00:40:57,829 --> 00:40:54,400

academic space science centers in any

1164
00:41:01,670 --> 00:41:00,069
i would hope so

1165
00:41:03,750 --> 00:41:01,680
you know you have to it's very

1166
00:41:05,510 --> 00:41:03,760
interesting how you sell missions

1167
00:41:07,670 --> 00:41:05,520
there's a really cool program in nasa

1168
00:41:08,950 --> 00:41:07,680
called the explorer program so every few

1169
00:41:11,109 --> 00:41:08,960
years you've got an opportunity and you

1170
00:41:12,710 --> 00:41:11,119
can propose anything you want and that

1171
00:41:14,950 --> 00:41:12,720
was what the image program was and

1172
00:41:17,109 --> 00:41:14,960
that's uh very satisfying and that's the

1173
00:41:18,870 --> 00:41:17,119
field is really taking some really real

1174
00:41:21,109 --> 00:41:18,880
leaps by the explorer program but these

1175
00:41:23,670 --> 00:41:21,119
are small like you know one-fifth the

1176
00:41:24,870 --> 00:41:23,680
size of mms for the big missions you

1177
00:41:26,870 --> 00:41:24,880
have to sell it through the national

1178
00:41:28,710 --> 00:41:26,880
academy this means committees of

1179
00:41:30,309 --> 00:41:28,720
hundreds and hundreds of people

1180
00:41:33,190 --> 00:41:30,319
filter it all out and finally you know

1181
00:41:35,589 --> 00:41:33,200
here's the priorities and in 2003 mms

1182
00:41:37,750 --> 00:41:35,599
was the number one priority in solar and

1183
00:41:40,550 --> 00:41:37,760
space physics for the national academy

1184
00:41:43,270 --> 00:41:40,560
and if you say that nasa will move on it

1185
00:41:45,670 --> 00:41:43,280
the very next year or that same year

1186
00:41:47,670 --> 00:41:45,680
actually we were writing our proposal

1187
00:41:49,349 --> 00:41:47,680
so that's what they always say the

1188
00:41:51,349 --> 00:41:49,359

congress and nasa will say that the

1189
00:41:53,589 --> 00:41:51,359
cable survey is the bible so if you can

1190
00:41:55,349 --> 00:41:53,599
get a mission in there and then you can

1191
00:41:57,670 --> 00:41:55,359
propose and win it

1192
00:42:00,630 --> 00:41:57,680
okay that's a long process

1193
00:42:03,270 --> 00:42:00,640
so i'm certainly hoping that that that

1194
00:42:04,470 --> 00:42:03,280
process can continue it's it should but

1195
00:42:06,390 --> 00:42:04,480
i can't tell you what the missions are

1196
00:42:07,670 --> 00:42:06,400
going to be

1197
00:42:10,230 --> 00:42:07,680
i follow up on your question a little

1198
00:42:12,230 --> 00:42:10,240
more practically um

1199
00:42:15,030 --> 00:42:12,240
i would hope the success of this

1200
00:42:16,069 --> 00:42:15,040
fosters what you said because the the uh

1201
00:42:18,950 --> 00:42:16,079
i mean

1202
00:42:20,390 --> 00:42:18,960
the scope and the and the um the quality

1203
00:42:21,670 --> 00:42:20,400
of the engineering that we saw come out

1204
00:42:22,710 --> 00:42:21,680
especially at uni university of new

1205
00:42:24,150 --> 00:42:22,720
hampshire and the challenge that was

1206
00:42:26,470 --> 00:42:24,160
taken on was not

1207
00:42:27,910 --> 00:42:26,480
small build a single instrument it was

1208
00:42:29,990 --> 00:42:27,920
they saw some very large engineering

1209
00:42:32,710 --> 00:42:30,000
problems and managed all a whole suite

1210
00:42:34,470 --> 00:42:32,720
of fields instruments i mean it was was

1211
00:42:38,950 --> 00:42:34,480
very impressive so hopefully that too

1212
00:42:44,390 --> 00:42:42,069
all right any further questions

1213
00:42:45,829 --> 00:42:44,400

all right and we do not have any uh

1214
00:42:47,349 --> 00:42:45,839
daryl you got to follow up what was the

1215
00:42:51,510 --> 00:42:47,359
total cost of this program from the

1216
00:42:56,550 --> 00:42:53,589
so the

1217
00:42:58,309 --> 00:42:56,560
the the the total cost including launch

1218
00:43:03,030 --> 00:42:58,319
vehicle and everything's around 1.1

1219
00:43:07,750 --> 00:43:05,910
and okay one one more follow-up here hi

1220
00:43:09,750 --> 00:43:07,760
ken kramer for america's space again uh

1221
00:43:11,270 --> 00:43:09,760
for vern thorpe um

1222
00:43:13,430 --> 00:43:11,280
you mentioned there's a very long time

1223
00:43:16,069 --> 00:43:13,440
for prep work can you describe why it

1224
00:43:18,630 --> 00:43:16,079
took so long to to prepare this and

1225
00:43:20,550 --> 00:43:18,640
integrate these satellites

1226
00:43:22,950 --> 00:43:20,560
i think we could have done it on a more

1227
00:43:24,550 --> 00:43:22,960
nominal nominal timeline which for a

1228
00:43:26,309 --> 00:43:24,560
nasa mission would probably

1229
00:43:28,950 --> 00:43:26,319
be around three years two and a half to

1230
00:43:31,030 --> 00:43:28,960
three years but we had the opportunity

1231
00:43:32,870 --> 00:43:31,040
to nasa had the opportunity to select

1232
00:43:35,270 --> 00:43:32,880
the launch vehicle six years in advance

1233
00:43:37,030 --> 00:43:35,280
and whenever you can do that it's nice

1234
00:43:39,349 --> 00:43:37,040
for the spacecraft team

1235
00:43:42,150 --> 00:43:39,359
to know what they're going to fly on

1236
00:43:43,910 --> 00:43:42,160
they can begin working right away to

1237
00:43:45,270 --> 00:43:43,920
understand and detail the exact

1238
00:43:47,270 --> 00:43:45,280

environments that they're going to have

1239
00:43:49,270 --> 00:43:47,280
to design to they don't have to do

1240
00:43:50,950 --> 00:43:49,280
enveloping analyses you know covering

1241
00:43:52,390 --> 00:43:50,960
all the possible launch vehicles out

1242
00:43:56,630 --> 00:43:52,400
there

1243
00:43:59,030 --> 00:43:56,640
of events that uh the opportunity

1244
00:44:01,670 --> 00:43:59,040
presented presented itself nasa took

1245
00:44:04,069 --> 00:44:01,680
advantage of it and as a result we were

1246
00:44:06,630 --> 00:44:04,079
able to define requirements early which

1247
00:44:08,309 --> 00:44:06,640
always benefits the spacecraft program

1248
00:44:10,790 --> 00:44:08,319
oftentimes when a launch vehicle gets

1249
00:44:13,109 --> 00:44:10,800
involved the spacecraft is already at

1250
00:44:15,030 --> 00:44:13,119
its critical design review and if we run

1251
00:44:17,510 --> 00:44:15,040
into a requirements and compatibility

1252
00:44:19,349 --> 00:44:17,520
even a minor one it it costs a lot more

1253
00:44:21,589 --> 00:44:19,359
to to solve that

1254
00:44:23,349 --> 00:44:21,599
we were able to avoid all that on mms

1255
00:44:26,630 --> 00:44:23,359
but if we had needed to do it in three

1256
00:44:30,790 --> 00:44:28,470
i'm wondering specifically about this

1257
00:44:33,270 --> 00:44:30,800
satellite like the magnetic environment

1258
00:44:34,950 --> 00:44:33,280
you're using extended payload fairing

1259
00:44:37,349 --> 00:44:34,960
i know it's very cramped inside the

1260
00:44:39,109 --> 00:44:37,359
payload fairing and because of the size

1261
00:44:41,510 --> 00:44:39,119
of the satellite so did that contribute

1262
00:44:43,829 --> 00:44:41,520
to it or can you talk about those issues

1263
00:44:46,069 --> 00:44:43,839

that wasn't really a problem they it is

1264
00:44:47,829 --> 00:44:46,079
true that this stack of satellites fills

1265
00:44:49,430 --> 00:44:47,839
up the cylinder the cylindrical section

1266
00:44:50,390 --> 00:44:49,440
of our longest four meter payload

1267
00:44:51,990 --> 00:44:50,400
fairing

1268
00:44:54,150 --> 00:44:52,000
but it stays within the allowable

1269
00:44:56,230 --> 00:44:54,160
envelope we have a an envelope defined

1270
00:44:59,109 --> 00:44:56,240
within that fairing that as long as the

1271
00:45:00,309 --> 00:44:59,119
spacecraft stays within it it's fine it

1272
00:45:01,990 --> 00:45:00,319
accounts for all the you know the

1273
00:45:05,349 --> 00:45:02,000
relative motion that takes place during

1274
00:45:06,630 --> 00:45:05,359
flight so that really wasn't an issue um

1275
00:45:07,990 --> 00:45:06,640
probably the most challenging some of

1276
00:45:09,750 --> 00:45:08,000
the most challenging requirements on

1277
00:45:12,069 --> 00:45:09,760
this mission were the magnetic

1278
00:45:13,589 --> 00:45:12,079
cleanliness that we talked about but uh

1279
00:45:15,270 --> 00:45:13,599
you know goddard was in charge of that

1280
00:45:16,870 --> 00:45:15,280
so it really was not hard for us to

1281
00:45:19,270 --> 00:45:16,880
comply with that

1282
00:45:21,670 --> 00:45:19,280
and because the four spacecraft are

1283
00:45:23,270 --> 00:45:21,680
stacked we had some unique physical

1284
00:45:25,190 --> 00:45:23,280
interfaces the

1285
00:45:27,750 --> 00:45:25,200
electrical umbilicals and purge lines

1286
00:45:29,990 --> 00:45:27,760
for example come in from the side rather

1287
00:45:31,670 --> 00:45:30,000
than coming up from the bottom like they

1288
00:45:33,990 --> 00:45:31,680

traditionally do when you fly a single

1289
00:45:35,829 --> 00:45:34,000
spacecraft so we have these draped

1290
00:45:37,109 --> 00:45:35,839
lanyards that extend across from the

1291
00:45:38,230 --> 00:45:37,119
side of the payload fairing and

1292
00:45:40,630 --> 00:45:38,240
interface with the side of the

1293
00:45:42,390 --> 00:45:40,640
spacecraft we've done that before on

1294
00:45:43,750 --> 00:45:42,400
other missions as well but it's a little

1295
00:45:45,349 --> 00:45:43,760
unusual i think this is the first time

1296
00:45:47,270 --> 00:45:45,359
we've done it for four spacecraft at the

1297
00:45:50,470 --> 00:45:47,280
same time

1298
00:45:52,069 --> 00:45:50,480
and i'd follow on with that that

1299
00:45:53,990 --> 00:45:52,079
we do use the whole fairing but it's

1300
00:45:56,390 --> 00:45:54,000
it's not because we almost don't grew it

1301
00:45:58,069 --> 00:45:56,400
it's it's really that we optimized

1302
00:46:00,390 --> 00:45:58,079
to exploit the fairing we have being

1303
00:46:02,150 --> 00:46:00,400
that we have fixed solar arrays

1304
00:46:04,470 --> 00:46:02,160
the physical size of our spacecraft you

1305
00:46:06,230 --> 00:46:04,480
know equates to our power margin and

1306
00:46:08,630 --> 00:46:06,240
such both the height and the width so

1307
00:46:10,150 --> 00:46:08,640
essentially we designed to optimize the

1308
00:46:12,230 --> 00:46:10,160
the four meter fairing once it was

1309
00:46:16,950 --> 00:46:12,240
established and use every bit of it to

1310
00:46:20,710 --> 00:46:18,550
all right

1311
00:46:22,309 --> 00:46:20,720
seeing no other questions and we have no

1312
00:46:25,270 --> 00:46:22,319
phone in questions

1313
00:46:26,309 --> 00:46:25,280

or online so a couple of programming

1314
00:46:28,309 --> 00:46:26,319
notes

1315
00:46:30,630 --> 00:46:28,319
first of all the rollout is tomorrow

1316
00:46:33,270 --> 00:46:30,640
morning at ten o'clock and we will be

1317
00:46:35,670 --> 00:46:33,280
playing some of that on nasa television

1318
00:46:36,710 --> 00:46:35,680
and then also tomorrow afternoon at one

1319
00:46:39,670 --> 00:46:36,720
o'clock

1320
00:46:42,630 --> 00:46:39,680
will be a completely unabridged mission

1321
00:46:43,990 --> 00:46:42,640
science briefing on mms so invite you to

1322
00:46:47,030 --> 00:46:44,000
come back and

1323
00:46:51,430 --> 00:46:47,040
tune in then for a even broader picture

1324
00:46:53,109 --> 00:46:51,440
of the mms science objectives

1325
00:46:57,910 --> 00:46:53,119
so for further information if you would