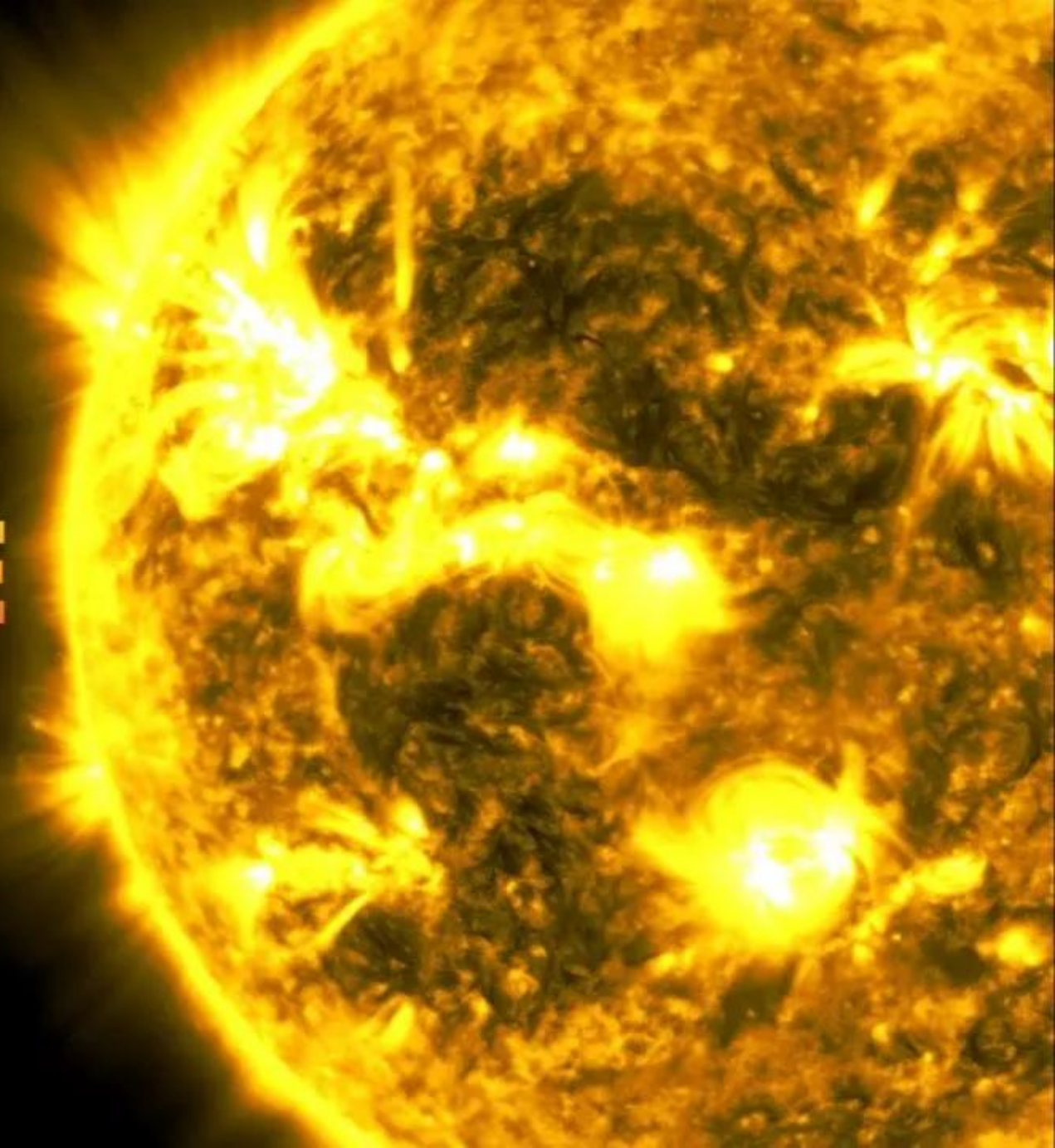
# OUR NEXT SOLAR CYCLE

NASA SCIENCE LIVE



1
00:00:15,270 --> 00:00:12,470
hello

2
00:00:16,950 --> 00:00:15,280
and welcome to another virtual episode

3
00:00:19,189 --> 00:00:16,960
of nasa science live

4
00:00:20,870 --> 00:00:19,199
i'm your host joy ung and i'm so happy

5
00:00:23,590 --> 00:00:20,880
you could join us today to hear an

6
00:00:25,589 --> 00:00:23,600
exciting announcement about our sun

7
00:00:27,750 --> 00:00:25,599
first let's learn a little bit about our

8
00:00:29,750 --> 00:00:27,760
style

9
00:00:32,229 --> 00:00:29,760
there's a rhythm emanating from the sun

10
00:00:34,709 --> 00:00:32,239
to the edges of the solar system

11
00:00:36,870 --> 00:00:34,719
roughly every 11 years our star ramps up

12
00:00:38,069 --> 00:00:36,880
to a turbulent state expelling violent

13
00:00:40,389 --> 00:00:38,079

eruptions

14
00:00:43,190 --> 00:00:40,399
after a peak it comes down to a quiet

15
00:00:45,990 --> 00:00:43,200
phase before starting all over again

16
00:00:46,950 --> 00:00:46,000
this is known as the solar cycle this

17
00:00:49,350 --> 00:00:46,960
ebb and flow of

18
00:00:50,229 --> 00:00:49,360
solar activity affects the entire solar

19
00:00:52,229 --> 00:00:50,239
system

20
00:00:54,150 --> 00:00:52,239
including spacecraft electronics and

21
00:00:55,830 --> 00:00:54,160
astronauts that can be affected by

22
00:00:58,229 --> 00:00:55,840
particle radiation if they're not

23
00:01:00,310 --> 00:00:58,239
sufficiently protected

24
00:01:02,549 --> 00:01:00,320
understanding the solar cycle is one of

25
00:01:04,630 --> 00:01:02,559
the oldest problems in solar physics

26
00:01:06,789 --> 00:01:04,640
and now predicting it is more critical

27
00:01:13,590 --> 00:01:06,799
than ever as we venture to the moon

28
00:01:16,550 --> 00:01:13,600
mars and beyond so today we're joined by

29
00:01:18,310 --> 00:01:16,560
three experts we have dr nikki fox

30
00:01:20,870 --> 00:01:18,320
heliophysics division director

31
00:01:21,429 --> 00:01:20,880
at nasa headquarters walkthrough elsaya

32
00:01:23,109 --> 00:01:21,439
talat

33
00:01:25,190 --> 00:01:23,119
director of the office of project

34
00:01:27,670 --> 00:01:25,200
planning and analysis at

35
00:01:29,350 --> 00:01:27,680
noaa and dr jacob bleacher chief

36
00:01:31,350 --> 00:01:29,360
exploration scientist at nasa

37
00:01:34,630 --> 00:01:31,360
headquarters

38
00:01:37,109 --> 00:01:34,640

thank you so much for joining us today

39
00:01:40,069 --> 00:01:37,119
so nikki thanks for having us alas what

40
00:01:43,190 --> 00:01:40,079
the exciting news is

41
00:01:43,749 --> 00:01:43,200
i can yes today we're very excited to

42
00:01:46,630 --> 00:01:43,759
confirm

43
00:01:49,429 --> 00:01:46,640
that we are in a new solar cycle so we

44
00:01:51,590 --> 00:01:49,439
have entered solar cycle 25.

45
00:01:52,710 --> 00:01:51,600
and um that's important for us because

46
00:01:55,910 --> 00:01:52,720
it means we're going to see

47
00:01:57,830 --> 00:01:55,920
a whole new aspect of our star again um

48
00:01:59,670 --> 00:01:57,840
the way that we traditionally

49
00:02:01,749 --> 00:01:59,680
characterize a solar cycle

50
00:02:03,670 --> 00:02:01,759
is by counting the number of sunspots

51
00:02:05,510 --> 00:02:03,680
that you can see on the disk of the sun

52
00:02:07,190 --> 00:02:05,520
and so when we're at a minimum as you

53
00:02:08,869 --> 00:02:07,200
see by those little valleys there

54
00:02:10,389 --> 00:02:08,879
that's what we call solar minimum and

55
00:02:13,430 --> 00:02:10,399
then as you get to the peak

56
00:02:15,830 --> 00:02:13,440
uh that is solar maximum and so we see

57
00:02:16,630 --> 00:02:15,840
very very different types of activity on

58
00:02:18,949 --> 00:02:16,640
our star

59
00:02:20,869 --> 00:02:18,959
and we're excited that we are heading up

60
00:02:23,190 --> 00:02:20,879
for another solar cycle

61
00:02:25,030 --> 00:02:23,200
you see that in the video solar minimum

62
00:02:25,670 --> 00:02:25,040
just one or two of those little dark

63
00:02:27,910 --> 00:02:25,680

spots

64
00:02:28,710 --> 00:02:27,920
on the disk of the sun solar maximum

65
00:02:31,110 --> 00:02:28,720
lots of them

66
00:02:33,030 --> 00:02:31,120
what that corresponds to is a not such

67
00:02:34,869 --> 00:02:33,040
an active star at solar minimum

68
00:02:36,790 --> 00:02:34,879
but boy look at all those wonderful

69
00:02:37,750 --> 00:02:36,800
active regions that you can see there at

70
00:02:39,509 --> 00:02:37,760
solar maximum

71
00:02:42,150 --> 00:02:39,519
so it's a great time to be a

72
00:02:44,070 --> 00:02:42,160
heliophysicist

73
00:02:46,309 --> 00:02:44,080
wow that's really interesting so i'm

74
00:02:48,630 --> 00:02:46,319
curious to know what happens during each

75
00:02:51,350 --> 00:02:48,640
phase of the cycle what does an active

76
00:02:52,949 --> 00:02:51,360
sun mean

77
00:02:55,190 --> 00:02:52,959
so there are all kinds of different

78
00:02:57,110 --> 00:02:55,200
things on our on our star so at solar

79
00:03:00,630 --> 00:02:57,120
minimum we tend to see a fairly

80
00:03:03,509 --> 00:03:00,640
uniform circle circular disk or sphere

81
00:03:05,030 --> 00:03:03,519
um with with not too much activity in it

82
00:03:06,309 --> 00:03:05,040
that doesn't mean that it can't throw

83
00:03:07,910 --> 00:03:06,319
something away

84
00:03:10,070 --> 00:03:07,920
it just means that it becomes more

85
00:03:11,670 --> 00:03:10,080
probable with more and more of those

86
00:03:14,630 --> 00:03:11,680
pockets of activity

87
00:03:15,350 --> 00:03:14,640
in around the equatorial region of the

88
00:03:17,430 --> 00:03:15,360

sun

89
00:03:18,790 --> 00:03:17,440
that's exactly where we are are sort of

90
00:03:21,030 --> 00:03:18,800
sitting on that plane

91
00:03:22,149 --> 00:03:21,040
here at earth and so that means that we

92
00:03:24,390 --> 00:03:22,159
are once again

93
00:03:28,309 --> 00:03:24,400
in kind of the target region for big

94
00:03:30,550 --> 00:03:28,319
solar activity to come our way

95
00:03:32,390 --> 00:03:30,560
so this is a question for all of you why

96
00:03:35,750 --> 00:03:32,400
is following the solar cycle

97
00:03:36,949 --> 00:03:35,760
important so i think we're all going to

98
00:03:39,990 --> 00:03:36,959
have a slightly different

99
00:03:40,470 --> 00:03:40,000
aspect to this um as a scientist as a

100
00:03:43,110 --> 00:03:40,480
you know

101
00:03:44,949 --> 00:03:43,120
the heliophysics scientist i am just

102
00:03:46,789 --> 00:03:44,959
excited about the star in general

103
00:03:48,949 --> 00:03:46,799
we live with a star kind of in our

104
00:03:51,110 --> 00:03:48,959
backyard so we can actually

105
00:03:53,030 --> 00:03:51,120
even though it's hard to do we can send

106
00:03:56,390 --> 00:03:53,040
missions right up to

107
00:03:58,789 --> 00:03:56,400
uh very close to our star um we can

108
00:04:00,390 --> 00:03:58,799
really study its impact we can study how

109
00:04:03,030 --> 00:04:00,400
the activity changes

110
00:04:04,470 --> 00:04:03,040
how it impacts our planet how it impacts

111
00:04:06,949 --> 00:04:04,480
well beyond our planet

112
00:04:07,830 --> 00:04:06,959
and of course how it shapes our place in

113
00:04:10,390 --> 00:04:07,840

the universe

114
00:04:11,350 --> 00:04:10,400
as we are orbiting the milky way and you

115
00:04:13,509 --> 00:04:11,360
see of course there

116
00:04:15,190 --> 00:04:13,519
parker solar probe up there really

117
00:04:18,150 --> 00:04:15,200
really close to the sun

118
00:04:20,469 --> 00:04:18,160
making measurements um in that in the

119
00:04:22,950 --> 00:04:20,479
actual atmosphere of a star so

120
00:04:24,310 --> 00:04:22,960
um that's why i'm interested but elsa

121
00:04:27,990 --> 00:04:24,320
and jake will have slightly different

122
00:04:30,790 --> 00:04:28,000
perspectives to add

123
00:04:32,710 --> 00:04:30,800
yeah so nikki from from our perspective

124
00:04:34,710 --> 00:04:32,720
noah's responsibility is to provide

125
00:04:36,150 --> 00:04:34,720
the operational space whether the

126
00:04:37,590 --> 00:04:36,160
products and services

127
00:04:40,150 --> 00:04:37,600
that meet the evolving needs of the

128
00:04:42,550 --> 00:04:40,160
nation as we move towards solar max for

129
00:04:44,950 --> 00:04:42,560
we're preparing for an increase in solar

130
00:04:47,270 --> 00:04:44,960
and subsequent space uh this solar

131
00:04:48,150 --> 00:04:47,280
activity manifests in various explosive

132
00:04:49,749 --> 00:04:48,160
waves

133
00:04:51,510 --> 00:04:49,759
solar flares which are bursts of

134
00:04:52,150 --> 00:04:51,520
electromagnetic energy coming from the

135
00:04:53,990 --> 00:04:52,160
sun

136
00:04:56,230 --> 00:04:54,000
and these are often accompanied by

137
00:04:59,430 --> 00:04:56,240
energetic particles that can travel

138
00:05:01,110 --> 00:04:59,440

about half the speed of light and some

139
00:05:03,350 --> 00:05:01,120
of the biggest explosions that we see on

140
00:05:06,230 --> 00:05:03,360
the sun the coronal mass extensions

141
00:05:07,909 --> 00:05:06,240
these are expulsions of plasma and

142
00:05:09,990 --> 00:05:07,919
magnetic field from the sun's

143
00:05:10,950 --> 00:05:10,000
our atmosphere the corona and they can

144
00:05:13,510 --> 00:05:10,960
eject billions of

145
00:05:14,070 --> 00:05:13,520
tons of coronal material at times

146
00:05:16,950 --> 00:05:14,080
millions of

147
00:05:17,909 --> 00:05:16,960
miles per hour into interplanetary space

148
00:05:19,909 --> 00:05:17,919
all of these

149
00:05:21,510 --> 00:05:19,919
events can impact our technological

150
00:05:28,070 --> 00:05:21,520
society in our space

151
00:05:31,670 --> 00:05:30,710
and just as an understanding what the

152
00:05:33,990 --> 00:05:31,680
sun is doing

153
00:05:35,590 --> 00:05:34,000
and how it impacts us here on the earth

154
00:05:38,070 --> 00:05:35,600
and around the earth

155
00:05:40,310 --> 00:05:38,080
nasa also cares about how that impacts

156
00:05:42,230 --> 00:05:40,320
our assets out in deep space

157
00:05:44,310 --> 00:05:42,240
a really exciting time for human

158
00:05:45,510 --> 00:05:44,320
exploration we're moving beyond low

159
00:05:47,350 --> 00:05:45,520
earth orbit

160
00:05:49,909 --> 00:05:47,360
sending astronauts to the south pole of

161
00:05:52,310 --> 00:05:49,919
the moon through the artemis program

162
00:05:54,070 --> 00:05:52,320
these astronauts on these trips they're

163
00:05:55,670 --> 00:05:54,080

going to be exposed to time periods

164
00:05:56,790 --> 00:05:55,680
where they're outside of the earth's

165
00:05:58,550 --> 00:05:56,800
magnetic field

166
00:06:00,070 --> 00:05:58,560
and that's what protects us in some ways

167
00:06:02,309 --> 00:06:00,080
from that solar

168
00:06:04,070 --> 00:06:02,319
environment so for us it's really

169
00:06:04,710 --> 00:06:04,080
important to understand what the sun is

170
00:06:10,070 --> 00:06:04,720
doing

171
00:06:12,469 --> 00:06:10,080
occurring

172
00:06:14,390 --> 00:06:12,479
because if we can understand that well i

173
00:06:16,790 --> 00:06:14,400
like to call it we can predict

174
00:06:18,390 --> 00:06:16,800
prepare and mitigate so understanding

175
00:06:19,189 --> 00:06:18,400
from our colleagues what the sun is

176
00:06:21,189 --> 00:06:19,199
going to do

177
00:06:22,790 --> 00:06:21,199
what the environment's going to be helps

178
00:06:27,189 --> 00:06:22,800
us protect our astronauts and our

179
00:06:31,270 --> 00:06:29,990
so our star goes through a roughly 11

180
00:06:33,110 --> 00:06:31,280
year cycle

181
00:06:35,110 --> 00:06:33,120
do other stars go through a similar

182
00:06:37,990 --> 00:06:35,120
cycle

183
00:06:38,710 --> 00:06:38,000
so we certainly see um other stars that

184
00:06:41,110 --> 00:06:38,720
have kind of

185
00:06:42,469 --> 00:06:41,120
weather like like we do so like we have

186
00:06:45,270 --> 00:06:42,479
our solar flares

187
00:06:47,189 --> 00:06:45,280
and our solar wind we do know that there

188
00:06:49,589 --> 00:06:47,199

are other stars that also we see

189
00:06:51,990 --> 00:06:49,599
stellar flares uh they can be much much

190
00:06:52,790 --> 00:06:52,000
bigger and more violent than ours here

191
00:06:55,029 --> 00:06:52,800
on our sun

192
00:06:56,390 --> 00:06:55,039
they can also be much smaller and we do

193
00:06:59,510 --> 00:06:56,400
know that

194
00:07:00,390 --> 00:06:59,520
other stars also expands the way but the

195
00:07:03,270 --> 00:07:00,400
key for us

196
00:07:04,309 --> 00:07:03,280
is we can go actually study our sun we

197
00:07:06,150 --> 00:07:04,319
look at our sun

198
00:07:08,390 --> 00:07:06,160
in every single different wavelength we

199
00:07:11,110 --> 00:07:08,400
look at all of the different activity

200
00:07:11,430 --> 00:07:11,120
we have a wonderful armada of spacecraft

201
00:07:13,990 --> 00:07:11,440
that

202
00:07:14,629 --> 00:07:14,000
are all around our star really making

203
00:07:17,350 --> 00:07:14,639
sure that we

204
00:07:18,950 --> 00:07:17,360
understand what our star is doing and

205
00:07:22,150 --> 00:07:18,960
that's why we're really excited

206
00:07:25,029 --> 00:07:22,160
to be part of the artemis mission to

207
00:07:26,230 --> 00:07:25,039
to really you know take our exploration

208
00:07:29,029 --> 00:07:26,240
take our astronauts

209
00:07:30,070 --> 00:07:29,039
back to the moon and beyond um each of

210
00:07:32,950 --> 00:07:30,080
these spacecraft

211
00:07:34,629 --> 00:07:32,960
in key locations giving us all of those

212
00:07:36,629 --> 00:07:34,639
really really critical data

213
00:07:38,870 --> 00:07:36,639

to be able to better support our

214
00:07:40,390 --> 00:07:38,880
astronauts so it's it's it's just a

215
00:07:45,189 --> 00:07:40,400
great time to be

216
00:07:47,670 --> 00:07:45,199
part of exploration

217
00:07:48,230 --> 00:07:47,680
so so on earth we're safe from the

218
00:07:51,350 --> 00:07:48,240
increased

219
00:07:53,110 --> 00:07:51,360
solar activity from solar cycle 25 but

220
00:07:55,110 --> 00:07:53,120
things like spacecraft satellites and

221
00:07:57,510 --> 00:07:55,120
even astronauts in low earth orbit

222
00:07:58,710 --> 00:07:57,520
could be impacted by the space weather

223
00:08:00,710 --> 00:07:58,720
that you just mentioned

224
00:08:02,950 --> 00:08:00,720
so can we dive deep into you know what

225
00:08:03,430 --> 00:08:02,960
is space weather and how does the solar

226
00:08:08,869 --> 00:08:03,440
cycle

227
00:08:12,230 --> 00:08:11,189
so the the term space weather refers to

228
00:08:14,230 --> 00:08:12,240
the very

229
00:08:15,909 --> 00:08:14,240
conditions on it in space that can

230
00:08:16,950 --> 00:08:15,919
influence the performance of technology

231
00:08:18,629 --> 00:08:16,960
we use on earth

232
00:08:20,309 --> 00:08:18,639
and our assets explorers in space as you

233
00:08:23,110 --> 00:08:20,319
just said uh the

234
00:08:24,070 --> 00:08:23,120
the and these the solar impacts are real

235
00:08:27,830 --> 00:08:24,080
we see them

236
00:08:30,230 --> 00:08:27,840
uh whenever there's um these space

237
00:08:31,909 --> 00:08:30,240
solar activity solar flares can cause

238
00:08:34,630 --> 00:08:31,919

radio blackouts that can impair

239
00:08:36,230 --> 00:08:34,640
hf communications important to airlines

240
00:08:39,350 --> 00:08:36,240
and emergency responders

241
00:08:41,670 --> 00:08:39,360
the energetic particles uh can can cause

242
00:08:43,110 --> 00:08:41,680
surface and deep dielectric charging of

243
00:08:45,430 --> 00:08:43,120
spacecraft

244
00:08:47,190 --> 00:08:45,440
and that can cause a build up and damage

245
00:08:48,230 --> 00:08:47,200
the spacecraft's electronics and solar

246
00:08:50,790 --> 00:08:48,240
panels

247
00:08:53,269 --> 00:08:50,800
the geomagnetic storms that develop from

248
00:08:56,790 --> 00:08:53,279
solar wind and coronal mass ejection

249
00:08:58,630 --> 00:08:56,800
effects on our magnetic field uh cause

250
00:09:00,949 --> 00:08:58,640
cause atmospheric heating increased

251
00:09:03,350 --> 00:09:00,959
atmospheric heating and increased drag

252
00:09:05,750 --> 00:09:03,360
for just a lot of operators that they

253
00:09:09,110 --> 00:09:05,760
have to deal with

254
00:09:11,829 --> 00:09:09,120
increased in the magnetic field

255
00:09:12,310 --> 00:09:11,839
text from an article from the sun it can

256
00:09:14,949 --> 00:09:12,320
induce

257
00:09:16,790 --> 00:09:14,959
currents in at the ground level uh

258
00:09:17,509 --> 00:09:16,800
adversely affecting pipelines and

259
00:09:20,550 --> 00:09:17,519
damaging

260
00:09:22,230 --> 00:09:20,560
our electric power grid so and then

261
00:09:24,389 --> 00:09:22,240
on top of that the ionized portion of

262
00:09:26,790 --> 00:09:24,399
the atmosphere departs from its

263
00:09:28,630 --> 00:09:26,800

uh normal state um affecting

264
00:09:30,710 --> 00:09:28,640
communications and navigation

265
00:09:32,710 --> 00:09:30,720
that we use for yes and the

266
00:09:33,509 --> 00:09:32,720
precipitation that we use every day in

267
00:09:35,750 --> 00:09:33,519
our phones

268
00:09:37,910 --> 00:09:35,760
and the precision gps used by airlines

269
00:09:39,590 --> 00:09:37,920
in surveying farming and drilling

270
00:09:41,350 --> 00:09:39,600
and so so these are just some of the

271
00:09:43,030 --> 00:09:41,360
effects that we we

272
00:09:45,269 --> 00:09:43,040
care about here on earth and in near

273
00:09:48,310 --> 00:09:45,279
earth space uh

274
00:09:51,350 --> 00:09:48,320
and and why we monitor solar activity

275
00:09:54,150 --> 00:09:51,360
and we're we're looking forward to the

276
00:09:57,030 --> 00:09:54,160
solar maximum and able to take care of

277
00:10:01,030 --> 00:09:59,190
and additionally for our humans who are

278
00:10:03,670 --> 00:10:01,040
going to be traveling to the moon and

279
00:10:05,750 --> 00:10:03,680
eventually onto mars we have to consider

280
00:10:07,829 --> 00:10:05,760
other things we we certainly also worry

281
00:10:10,870 --> 00:10:07,839
about our electronics and our hardware

282
00:10:12,069 --> 00:10:10,880
and the impact on our people as well but

283
00:10:12,949 --> 00:10:12,079
other things that you might not think

284
00:10:15,110 --> 00:10:12,959
about like

285
00:10:16,150 --> 00:10:15,120
our pharmaceuticals so if they take

286
00:10:17,990 --> 00:10:16,160
along some medicine

287
00:10:19,509 --> 00:10:18,000
to help with bumps and bruises or

288
00:10:20,710 --> 00:10:19,519

headaches or any other medicine that

289
00:10:22,630 --> 00:10:20,720
they may need

290
00:10:24,550 --> 00:10:22,640
we don't know for sure how they'll

291
00:10:26,710 --> 00:10:24,560
respond to that radiation environment

292
00:10:27,829 --> 00:10:26,720
and if they degrade at all over time we

293
00:10:29,910 --> 00:10:27,839
need to know that

294
00:10:31,990 --> 00:10:29,920
uh same with the food does the food

295
00:10:34,150 --> 00:10:32,000
maintain its uh its caloric value

296
00:10:35,030 --> 00:10:34,160
for us during a long trip to mars and

297
00:10:37,670 --> 00:10:35,040
back

298
00:10:39,190 --> 00:10:37,680
and so in addition to the armada that

299
00:10:42,550 --> 00:10:39,200
nikki mentioned

300
00:10:43,910 --> 00:10:42,560
uh human exploration is also putting

301
00:10:45,829 --> 00:10:43,920
some instruments in a place where they

302
00:10:47,350 --> 00:10:45,839
can contribute we're developing

303
00:10:49,829 --> 00:10:47,360
something called the gateway

304
00:10:50,470 --> 00:10:49,839
the gateway is going to be an orbiting

305
00:10:52,790 --> 00:10:50,480
vehicle

306
00:10:53,509 --> 00:10:52,800
around the moon that gets into a lunar

307
00:10:55,350 --> 00:10:53,519
orbit

308
00:10:57,269 --> 00:10:55,360
and gives us an opportunity to go from

309
00:10:58,949 --> 00:10:57,279
there down to the surface

310
00:11:00,389 --> 00:10:58,959
but we can also conduct scientific

311
00:11:01,910 --> 00:11:00,399
experiments at the gateway

312
00:11:03,670 --> 00:11:01,920
so the first two payloads we've

313
00:11:04,389 --> 00:11:03,680

identified are actually intended to

314
00:11:06,310 --> 00:11:04,399
measure

315
00:11:07,990 --> 00:11:06,320
the space weather and heliophysics

316
00:11:09,750 --> 00:11:08,000
environmental conditions there

317
00:11:11,670 --> 00:11:09,760
and that's kind of gives us the baseline

318
00:11:12,630 --> 00:11:11,680
so we can understand what the impact is

319
00:11:14,550 --> 00:11:12,640
on our hardware

320
00:11:19,990 --> 00:11:14,560
and our medicines and our food and our

321
00:11:23,269 --> 00:11:21,509
wow that's really exciting that we're

322
00:11:24,150 --> 00:11:23,279
putting new instruments to measure space

323
00:11:25,430 --> 00:11:24,160
weather

324
00:11:29,190 --> 00:11:25,440
so is space where there's something we

325
00:11:32,630 --> 00:11:29,200
can predict at the moment

326
00:11:35,670 --> 00:11:32,640
so yes we do a good job at predicting

327
00:11:37,829 --> 00:11:35,680
um with with the the tools that we have

328
00:11:39,509 --> 00:11:37,839
um we certainly we make the scientific

329
00:11:41,110 --> 00:11:39,519
measurements uh one of the great things

330
00:11:43,670 --> 00:11:41,120
about our helio fleet

331
00:11:45,030 --> 00:11:43,680
is each of each asset is there doing

332
00:11:48,069 --> 00:11:45,040
groundbreaking science

333
00:11:50,870 --> 00:11:48,079
but also the data are providing key

334
00:11:52,310 --> 00:11:50,880
inputs to all of the models that um al

335
00:11:54,470 --> 00:11:52,320
said was talking about

336
00:11:55,590 --> 00:11:54,480
that that are helping us to predict but

337
00:11:58,069 --> 00:11:55,600
of course the real

338
00:11:59,430 --> 00:11:58,079

um job for predicting our space weather

339
00:12:00,150 --> 00:11:59,440
is from the space weather prediction

340
00:12:01,990 --> 00:12:00,160
center so

341
00:12:03,990 --> 00:12:02,000
i'll hand over to i'll say it to to

342
00:12:06,069 --> 00:12:04,000
finish that one

343
00:12:07,949 --> 00:12:06,079
yes and it's a good hand up because we

344
00:12:10,710 --> 00:12:07,959
do that constantly between

345
00:12:11,350 --> 00:12:10,720
observation and the research that nasa

346
00:12:14,389 --> 00:12:11,360
does

347
00:12:15,350 --> 00:12:14,399
with the operations that noaa are a good

348
00:12:18,629 --> 00:12:15,360
spacecraft

349
00:12:21,670 --> 00:12:18,639
for because with thorough analysis of

350
00:12:23,430 --> 00:12:21,680
all the near real-time uh ground and

351
00:12:25,269 --> 00:12:23,440
basic observations that's the current

352
00:12:28,150 --> 00:12:25,279
solar and geophysical environment

353
00:12:28,629 --> 00:12:28,160
from the sun all the way to the earth um

354
00:12:31,430 --> 00:12:28,639
and

355
00:12:32,470 --> 00:12:31,440
species work at the space weather

356
00:12:35,269 --> 00:12:32,480
prediction center

357
00:12:36,790 --> 00:12:35,279
they work 24 7 um analyzing the

358
00:12:38,790 --> 00:12:36,800
recurrent patterns and the

359
00:12:41,670 --> 00:12:38,800
solar activities you can see here as the

360
00:12:44,629 --> 00:12:41,680
sun rotates and look at active regions

361
00:12:46,230 --> 00:12:44,639
and and compare those to past situations

362
00:12:47,670 --> 00:12:46,240
and you're using the numerical models

363
00:12:50,629 --> 00:12:47,680

that we imported from

364
00:12:52,389 --> 00:12:50,639
from uh research efforts they're able to

365
00:12:52,790 --> 00:12:52,399
predict space weather on time scales

366
00:12:55,829 --> 00:12:52,800
from

367
00:12:59,110 --> 00:12:55,839
hours to days to weeks and uh

368
00:12:59,670 --> 00:12:59,120
we're not just doing that uh um uh noaa

369
00:13:02,389 --> 00:12:59,680
but

370
00:13:04,069 --> 00:13:02,399
um just as a national weather service uh

371
00:13:06,230 --> 00:13:04,079
makes us a weather-ready nation

372
00:13:07,430 --> 00:13:06,240
what we're striving to is to be a space

373
00:13:09,190 --> 00:13:07,440
weather ready nation

374
00:13:11,750 --> 00:13:09,200
and we're doing that in a multi-agency

375
00:13:14,870 --> 00:13:11,760
fashion um and that's with the

376
00:13:16,629 --> 00:13:14,880
national space weather uh strategy and

377
00:13:18,710 --> 00:13:16,639
action plan where we're working with

378
00:13:22,150 --> 00:13:18,720
noaa the national science foundation

379
00:13:24,389 --> 00:13:22,160
the geological survey um to and then

380
00:13:25,670 --> 00:13:24,399
multiple other agencies to prepare

381
00:13:31,509 --> 00:13:25,680
ourselves from search

382
00:13:34,870 --> 00:13:33,430
so we're going to be ramping up in solar

383
00:13:37,509 --> 00:13:34,880
activity in the next

384
00:13:39,509 --> 00:13:37,519
few years um being in the new cycle now

385
00:13:40,470 --> 00:13:39,519
what are we doing to protect our space

386
00:13:46,230 --> 00:13:40,480
technologies

387
00:13:46,240 --> 00:13:50,550
well so we're creating

388
00:13:54,629 --> 00:13:53,189

okay for human exploration it's a big

389
00:13:55,509 --> 00:13:54,639
part of your prior question for

390
00:13:57,430 --> 00:13:55,519
predicting

391
00:13:59,910 --> 00:13:57,440
uh if we know what the environment will

392
00:14:02,870 --> 00:13:59,920
be like then we can prepare ourselves

393
00:14:04,470 --> 00:14:02,880
uh so we can prepare on the long term if

394
00:14:05,750 --> 00:14:04,480
they talk about the different time

395
00:14:08,230 --> 00:14:05,760
scales we can predict

396
00:14:09,670 --> 00:14:08,240
by designing our hardware in ways that

397
00:14:11,509 --> 00:14:09,680
they can be tolerant

398
00:14:13,590 --> 00:14:11,519
but on even on the shorter time scales

399
00:14:15,509 --> 00:14:13,600
if we know that an event has occurred

400
00:14:17,189 --> 00:14:15,519
then we can take certain mitigation

401
00:14:19,910 --> 00:14:17,199
steps for instance we could power down

402
00:14:20,310 --> 00:14:19,920
delicate electronics packages we could

403
00:14:22,470 --> 00:14:20,320
end

404
00:14:24,310 --> 00:14:22,480
extra vehicular activities and bring our

405
00:14:25,189 --> 00:14:24,320
astronauts in so that they can shelter

406
00:14:27,829 --> 00:14:25,199
in place

407
00:14:28,550 --> 00:14:27,839
in a protected location so for us it's

408
00:14:29,750 --> 00:14:28,560
kind of

409
00:14:32,230 --> 00:14:29,760
you know having that predictive

410
00:14:40,629 --> 00:14:32,240
capability really gives us the chance to

411
00:14:43,990 --> 00:14:42,310
so let's go ahead and answer some of

412
00:14:46,870 --> 00:14:44,000
your questions um from

413
00:14:48,790 --> 00:14:46,880

the hashtag asknasser uh remember please

414
00:14:50,470 --> 00:14:48,800
don't hesitate to send in your questions

415
00:14:51,430 --> 00:14:50,480
by writing in the comment box wherever

416
00:14:53,910 --> 00:14:51,440
you're watching this

417
00:14:55,350 --> 00:14:53,920
or by using the hashtag asknasa on

418
00:14:58,310 --> 00:14:55,360
social media

419
00:14:58,870 --> 00:14:58,320
so our first question is from per anna

420
00:15:01,189 --> 00:14:58,880
darling

421
00:15:02,550 --> 00:15:01,199
on facebook and they ask what is the

422
00:15:07,990 --> 00:15:02,560
prediction for the strength

423
00:15:11,990 --> 00:15:10,790
so that there are honestly you can talk

424
00:15:13,990 --> 00:15:12,000
to a number of different people and

425
00:15:16,550 --> 00:15:14,000
they'll give you very different answers

426
00:15:18,310 --> 00:15:16,560
um certainly the last solar cycle we saw

427
00:15:19,590 --> 00:15:18,320
was kind of a small one when you looked

428
00:15:20,710 --> 00:15:19,600
at that graphic at the beginning and

429
00:15:23,189 --> 00:15:20,720
looked at the previous

430
00:15:24,230 --> 00:15:23,199
four they were pretty big and then the

431
00:15:27,110 --> 00:15:24,240
one we've just come

432
00:15:30,150 --> 00:15:27,120
out of was a pretty small one however

433
00:15:33,030 --> 00:15:30,160
even in that really small one in 2012

434
00:15:34,629 --> 00:15:33,040
we actually saw the largest solar event

435
00:15:36,870 --> 00:15:34,639
that we've seen since the very famous

436
00:15:39,030 --> 00:15:36,880
carrington event in 1849

437
00:15:41,030 --> 00:15:39,040
and so even though the whole the number

438
00:15:42,629 --> 00:15:41,040

of sunspots can be lower that does not

439
00:15:44,870 --> 00:15:42,639
mean that there will be less

440
00:15:46,230 --> 00:15:44,880
activity and so we're expecting to see

441
00:15:49,990 --> 00:15:46,240
something that's probably very

442
00:15:53,110 --> 00:15:50,000
similar in in um number of sunspots

443
00:15:55,269 --> 00:15:53,120
to uh the the last one but um we're

444
00:15:56,150 --> 00:15:55,279
very much excited about getting a lot of

445
00:15:57,910 --> 00:15:56,160
activity

446
00:15:59,749 --> 00:15:57,920
and being able to test out all of our

447
00:16:01,269 --> 00:15:59,759
theories with all of all of the new

448
00:16:03,189 --> 00:16:01,279
measurements that we will be

449
00:16:06,150 --> 00:16:03,199
making we've got new spacecraft that

450
00:16:08,389 --> 00:16:06,160
have come on since the last solar cycle

451
00:16:09,670 --> 00:16:08,399
very excited for personally because

452
00:16:11,509 --> 00:16:09,680
parker solar probe

453
00:16:13,350 --> 00:16:11,519
launched just before the last solar

454
00:16:15,189 --> 00:16:13,360
minimum about a year before

455
00:16:17,269 --> 00:16:15,199
seven year mission means that she will

456
00:16:19,430 --> 00:16:17,279
be able to take data from

457
00:16:21,590 --> 00:16:19,440
all of that solar cycle all the way from

458
00:16:23,749 --> 00:16:21,600
minimum all the way up to maximum

459
00:16:25,430 --> 00:16:23,759
so totally new groundbreaking

460
00:16:28,949 --> 00:16:25,440
measurements that we've never had before

461
00:16:33,670 --> 00:16:32,069
so vicky smith on facebook asks where

462
00:16:40,470 --> 00:16:33,680
can we get current information

463
00:16:47,430 --> 00:16:44,150

i'll say it well certainly certainly the

464
00:16:51,509 --> 00:16:47,440
space weather prediction center uh gives

465
00:16:54,150 --> 00:16:51,519
us um solar and geomagnetic

466
00:16:55,269 --> 00:16:54,160
activity alerts you can find them online

467
00:16:57,670 --> 00:16:55,279
you can sign up

468
00:16:58,389 --> 00:16:57,680
to a subscription service to get in your

469
00:17:01,910 --> 00:16:58,399
email

470
00:17:04,230 --> 00:17:01,920
about any kind of uh solar activity

471
00:17:06,789 --> 00:17:04,240
and solar watches as well as uh

472
00:17:10,150 --> 00:17:06,799
geomagnetic activity in near earth space

473
00:17:12,789 --> 00:17:10,160
so uh you can find in real time what the

474
00:17:13,909 --> 00:17:12,799
what the uh activity is on the sun by

475
00:17:16,870 --> 00:17:13,919
going to the webpage

476
00:17:18,069 --> 00:17:16,880
and looking at uh the the space weather

477
00:17:21,669 --> 00:17:18,079
dashboard there

478
00:17:22,710 --> 00:17:21,679
um obviously for for historical data and

479
00:17:24,230 --> 00:17:22,720
archival data

480
00:17:25,909 --> 00:17:24,240
i mean you've seen some of the beautiful

481
00:17:28,150 --> 00:17:25,919
imagery that we get from uh

482
00:17:29,909 --> 00:17:28,160
from space that nasa has uh from the

483
00:17:32,950 --> 00:17:29,919
solar dynamic observatory

484
00:17:33,590 --> 00:17:32,960
and from the noaa suvi instrument as

485
00:17:36,710 --> 00:17:33,600
well

486
00:17:39,510 --> 00:17:36,720
uh so so there is there's a wealth of

487
00:17:41,190 --> 00:17:39,520
of of data that we can you can you can

488
00:17:43,510 --> 00:17:41,200

have about solar flares from

489
00:17:47,510 --> 00:17:43,520
from both space-based and ground-based

490
00:17:50,549 --> 00:17:47,520
uh observatories

491
00:17:51,430 --> 00:17:50,559
so columbia on periscope asks what are

492
00:17:54,710 --> 00:17:51,440
sun spots

493
00:17:57,110 --> 00:17:54,720
and why are they dark

494
00:17:59,270 --> 00:17:57,120
that is a great question um and it

495
00:18:00,789 --> 00:17:59,280
depends what wavelength you look at them

496
00:18:02,390 --> 00:18:00,799
um and i'm sure we've got some wonderful

497
00:18:04,310 --> 00:18:02,400
videos that we can show you but

498
00:18:06,070 --> 00:18:04,320
if you look at them in invisible so this

499
00:18:08,549 --> 00:18:06,080
is a lovely picture invisible

500
00:18:09,110 --> 00:18:08,559
you can see that dark sunspot there that

501
00:18:10,950 --> 00:18:09,120
is

502
00:18:12,470 --> 00:18:10,960
rotating around and it's about the same

503
00:18:15,110 --> 00:18:12,480
size as the earth

504
00:18:16,710 --> 00:18:15,120
and it is it even though it looks dark

505
00:18:19,350 --> 00:18:16,720
and kind of boring and quiet

506
00:18:20,870 --> 00:18:19,360
that's actually a pocket a very very

507
00:18:22,390 --> 00:18:20,880
intense magnetic field

508
00:18:24,470 --> 00:18:22,400
and so when we look at the sun in

509
00:18:26,150 --> 00:18:24,480
extreme ultraviolet instead of seeing

510
00:18:28,470 --> 00:18:26,160
those dark splotches what you see

511
00:18:29,590 --> 00:18:28,480
is a lot of activity a lot of very

512
00:18:31,750 --> 00:18:29,600
bright spots

513
00:18:33,270 --> 00:18:31,760

so the reason that it is darker is it's

514
00:18:36,549 --> 00:18:33,280
actually constrained

515
00:18:37,270 --> 00:18:36,559
um it is it is a lower altitude to the

516
00:18:41,270 --> 00:18:37,280
rest of the

517
00:18:43,029 --> 00:18:41,280
the um the solar environment around it

518
00:18:44,549 --> 00:18:43,039
and so it's actually constrained at a

519
00:18:46,390 --> 00:18:44,559
slightly cooler temperature

520
00:18:47,750 --> 00:18:46,400
and so it looks like it's it's kind of

521
00:18:50,789 --> 00:18:47,760
cool and boring

522
00:18:55,669 --> 00:18:50,799
but actually it is very hot and very

523
00:18:59,430 --> 00:18:57,990
so we have a question from tim sweatson

524
00:19:02,230 --> 00:18:59,440
on facebook

525
00:19:03,830 --> 00:19:02,240
uh they say they ask i've heard some

526
00:19:04,470 --> 00:19:03,840
people talk about the next carrington

527
00:19:06,390 --> 00:19:04,480
event

528
00:19:08,549 --> 00:19:06,400
a major impact by a coronal mass

529
00:19:09,350 --> 00:19:08,559
ejection that happens roughly every 450

530
00:19:11,029 --> 00:19:09,360
years

531
00:19:12,549 --> 00:19:11,039
how is this event already overdues

532
00:19:15,430 --> 00:19:12,559
happen again

533
00:19:16,870 --> 00:19:15,440
i'm sorry how is this event already

534
00:19:18,549 --> 00:19:16,880
overdue to happen again

535
00:19:20,310 --> 00:19:18,559
and to what extent can we predict

536
00:19:22,150 --> 00:19:20,320
coronal mass ejections

537
00:19:23,430 --> 00:19:22,160
what can be done to prevent damage to

538
00:19:26,710 --> 00:19:23,440

our infrastructure

539
00:19:28,789 --> 00:19:26,720
should another event happen

540
00:19:30,070 --> 00:19:28,799
so i'll start and then hand over to i'll

541
00:19:33,590 --> 00:19:30,080
say it i think for this one

542
00:19:35,110 --> 00:19:33,600
um so for yes it's very easy to say well

543
00:19:37,350 --> 00:19:35,120
the last the last carrington event we

544
00:19:40,870 --> 00:19:37,360
saw was in 1849

545
00:19:42,630 --> 00:19:40,880
1859 sorry but um it that was one that

546
00:19:44,470 --> 00:19:42,640
actually impacted the earth we know that

547
00:19:46,070 --> 00:19:44,480
these things are going off all the time

548
00:19:47,909 --> 00:19:46,080
i actually mentioned that even during

549
00:19:51,350 --> 00:19:47,919
that very small um

550
00:19:52,230 --> 00:19:51,360
peak of the last solar cycle we saw a

551
00:19:55,350 --> 00:19:52,240
huge event

552
00:19:57,350 --> 00:19:55,360
in in 2012 july 2012 which was

553
00:19:59,510 --> 00:19:57,360
it actually did impact one of our

554
00:19:59,990 --> 00:19:59,520
scariest so it went off the side of the

555
00:20:01,909 --> 00:20:00,000
sun

556
00:20:03,510 --> 00:20:01,919
we were able to get all the data and

557
00:20:04,870 --> 00:20:03,520
when we did the modeling we saw it was

558
00:20:06,390 --> 00:20:04,880
actually much bigger even than the

559
00:20:09,590 --> 00:20:06,400
carrington event that it happened

560
00:20:11,270 --> 00:20:09,600
150 years before and so um

561
00:20:12,789 --> 00:20:11,280
we know that they're happening it's just

562
00:20:13,350 --> 00:20:12,799
whether or not they are actually going

563
00:20:15,830 --> 00:20:13,360

to be

564
00:20:17,669 --> 00:20:15,840
in coming to whether the earth is going

565
00:20:20,549 --> 00:20:17,679
to be in the path for them sorry

566
00:20:22,549 --> 00:20:20,559
um and so you know yes we're certainly

567
00:20:23,830 --> 00:20:22,559
overdue for one to come straight towards

568
00:20:26,310 --> 00:20:23,840
us but we are seeing

569
00:20:27,110 --> 00:20:26,320
big events on the sun um much more

570
00:20:28,870 --> 00:20:27,120
frequently

571
00:20:30,230 --> 00:20:28,880
and of course now we have so many more

572
00:20:31,990 --> 00:20:30,240
measurements in space

573
00:20:34,149 --> 00:20:32,000
it just means that we will be able to

574
00:20:36,070 --> 00:20:34,159
observe them whereas before

575
00:20:38,070 --> 00:20:36,080
we would miss it because it didn't

576
00:20:41,430 --> 00:20:38,080
impact the earth

577
00:20:45,350 --> 00:20:44,470
thanks thank you absolutely that 2012

578
00:20:48,710 --> 00:20:45,360
storm

579
00:20:51,830 --> 00:20:48,720
uh we missed it by nine days

580
00:20:55,110 --> 00:20:51,840
uh and uh that in a carrington level

581
00:20:57,029 --> 00:20:55,120
uh so uh lucky um

582
00:20:58,789 --> 00:20:57,039
but what we're doing to prepare this is

583
00:21:01,990 --> 00:20:58,799
this has been a priority

584
00:21:04,390 --> 00:21:02,000
um uh for the last several years

585
00:21:06,390 --> 00:21:04,400
to prepare and cross government

586
00:21:09,270 --> 00:21:06,400
multi-agency effort as i mentioned

587
00:21:10,230 --> 00:21:09,280
to renew the national space weather uh a

588
00:21:13,270 --> 00:21:10,240

program

589
00:21:15,990 --> 00:21:13,280
um to drive us to a a

590
00:21:17,270 --> 00:21:16,000
a ready nation to drive us

591
00:21:19,029 --> 00:21:17,280
transformational space weather from a

592
00:21:22,390 --> 00:21:19,039
research focused activity

593
00:21:25,510 --> 00:21:22,400
to a national operational priority

594
00:21:26,310 --> 00:21:25,520
and so so we've done this uh across the

595
00:21:29,430 --> 00:21:26,320
government

596
00:21:30,310 --> 00:21:29,440
um and where space weather has been into

597
00:21:32,950 --> 00:21:30,320
international

598
00:21:34,470 --> 00:21:32,960
national state and local emergency

599
00:21:37,190 --> 00:21:34,480
management exercises

600
00:21:39,190 --> 00:21:37,200
um uh and including for aviation

601
00:21:40,549 --> 00:21:39,200
operations and daily operations of the

602
00:21:42,070 --> 00:21:40,559
electric grid we have

603
00:21:44,070 --> 00:21:42,080
um strong connection with our

604
00:21:46,470 --> 00:21:44,080
stakeholders there um

605
00:21:47,909 --> 00:21:46,480
in other sectors of of our technological

606
00:21:51,029 --> 00:21:47,919
society and including

607
00:21:54,549 --> 00:21:51,039
uh with our with with the um uh

608
00:21:58,870 --> 00:21:54,559
uh nasa as we as they as they

609
00:22:00,710 --> 00:21:58,880
grasp us in in uh in space

610
00:22:01,909 --> 00:22:00,720
and uh just to follow on what nikki is

611
00:22:04,070 --> 00:22:01,919
saying um

612
00:22:05,029 --> 00:22:04,080
the significant progress that we're

613
00:22:08,310 --> 00:22:05,039

making in

614
00:22:11,190 --> 00:22:08,320
in the qualifications from the

615
00:22:12,390 --> 00:22:11,200
implement are plans on the operational

616
00:22:15,669 --> 00:22:12,400
side as well

617
00:22:16,870 --> 00:22:15,679
uh we are going to the next operational

618
00:22:20,070 --> 00:22:16,880
space weather mission

619
00:22:20,390 --> 00:22:20,080
the space weather follow-on 2l1 uh which

620
00:22:22,470 --> 00:22:20,400
is

621
00:22:23,909 --> 00:22:22,480
upstream of earth to get us the ups

622
00:22:26,789 --> 00:22:23,919
measurements of the solar wind

623
00:22:29,270 --> 00:22:26,799
is going to ride along uh with uh the

624
00:22:31,990 --> 00:22:29,280
nasa imap

625
00:22:33,669 --> 00:22:32,000
launch and uh imap is going to make

626
00:22:35,430 --> 00:22:33,679
great science that's going to help us

627
00:22:38,070 --> 00:22:35,440
it's our predictive capability at the

628
00:22:40,549 --> 00:22:38,080
same time this uh swiffel as we call it

629
00:22:41,990 --> 00:22:40,559
spawn l1 is going to make the upstream

630
00:22:42,950 --> 00:22:42,000
measurements and for the coronal imagery

631
00:22:46,310 --> 00:22:42,960
to look for these

632
00:22:46,950 --> 00:22:46,320
large events uh the carrington level

633
00:22:50,230 --> 00:22:46,960
events

634
00:22:53,270 --> 00:22:50,240
and hopefully uh that we can we we

635
00:22:55,510 --> 00:22:53,280
are uh are able to uh

636
00:22:56,710 --> 00:22:55,520
hand off to our stakeholders including

637
00:22:59,270 --> 00:22:56,720
space exploration

638
00:23:01,350 --> 00:22:59,280

for mitigative effects and and here i'll

639
00:23:04,310 --> 00:23:01,360
uh i'll see if jake wants to add

640
00:23:08,630 --> 00:23:06,070
yeah that's a you know that's a good

641
00:23:09,029 --> 00:23:08,640
question what we really need to know is

642
00:23:11,750 --> 00:23:09,039
just

643
00:23:12,630 --> 00:23:11,760
what we need to prepare for and uh you

644
00:23:14,549 --> 00:23:12,640
know we

645
00:23:16,630 --> 00:23:14,559
you know exploration and science go hand

646
00:23:18,470 --> 00:23:16,640
in hand and if we're gonna send

647
00:23:20,390 --> 00:23:18,480
astronauts out into space

648
00:23:22,789 --> 00:23:20,400
you know we need to understand what the

649
00:23:24,710 --> 00:23:22,799
to expect and so we can't really

650
00:23:26,390 --> 00:23:24,720
completely plan to avoid anything like

651
00:23:29,270 --> 00:23:26,400
that but we can plan

652
00:23:30,149 --> 00:23:29,280
to be ready for it and so uh one thing i

653
00:23:32,149 --> 00:23:30,159
like to say

654
00:23:33,909 --> 00:23:32,159
and kind of co-opted this phrase is that

655
00:23:35,190 --> 00:23:33,919
there's no bad weather there's just bad

656
00:23:37,430 --> 00:23:35,200
preparation

657
00:23:39,350 --> 00:23:37,440
so by understanding the data that's been

658
00:23:42,070 --> 00:23:39,360
collected by our colleagues

659
00:23:43,430 --> 00:23:42,080
and understanding the likelihood of

660
00:23:45,110 --> 00:23:43,440
events to occur

661
00:23:47,029 --> 00:23:45,120
then we can prepare for that we can

662
00:23:49,110 --> 00:23:47,039
build our systems that way

663
00:23:50,870 --> 00:23:49,120

that's why we're going to the moon first

664
00:23:53,190 --> 00:23:50,880
we want to go there and learn about

665
00:23:54,950 --> 00:23:53,200
living in deep space so that we can then

666
00:23:56,549 --> 00:23:54,960
make the much longer trek to a

667
00:23:58,070 --> 00:23:56,559
destination like mars

668
00:24:00,149 --> 00:23:58,080
so we really need to have science and

669
00:24:03,350 --> 00:24:00,159
exploration teamed up to to be able to

670
00:24:07,510 --> 00:24:05,269
so you should razz on facebook uh they

671
00:24:12,390 --> 00:24:07,520
are ask is space weather harmful to

672
00:24:16,390 --> 00:24:15,190
yeah it it it is and uh you know you can

673
00:24:17,990 --> 00:24:16,400
you can become sick

674
00:24:20,310 --> 00:24:18,000
you could become ill depending on the

675
00:24:22,390 --> 00:24:20,320
amount of exposure that you have

676
00:24:23,350 --> 00:24:22,400
but as i mentioned you can also try to

677
00:24:26,870 --> 00:24:23,360
mitigate that

678
00:24:28,630 --> 00:24:26,880
at risk so you know here on earth you

679
00:24:30,070 --> 00:24:28,640
can get a sunburn

680
00:24:31,430 --> 00:24:30,080
so you want to know what the weather is

681
00:24:33,029 --> 00:24:31,440
like if you're going to be going out

682
00:24:34,310 --> 00:24:33,039
with no shirt sleeves on you probably

683
00:24:36,149 --> 00:24:34,320
put on sunscreen

684
00:24:37,830 --> 00:24:36,159
out in deep space we need to know

685
00:24:39,029 --> 00:24:37,840
exactly what those conditions are going

686
00:24:41,669 --> 00:24:39,039
to be like

687
00:24:42,390 --> 00:24:41,679
so for instance on our vehicles we can

688
00:24:44,950 --> 00:24:42,400

design

689
00:24:46,070 --> 00:24:44,960
small shelter and place locations where

690
00:24:47,909 --> 00:24:46,080
maybe it's not perfect

691
00:24:50,070 --> 00:24:47,919
but it's at least better than it would

692
00:24:51,990 --> 00:24:50,080
be if they were in their spacesuit on an

693
00:24:55,190 --> 00:24:52,000
extra-vehicular activity

694
00:24:57,269 --> 00:24:55,200
um so we are very aware um from

695
00:24:58,310 --> 00:24:57,279
you know decades of research that

696
00:25:00,470 --> 00:24:58,320
radiation

697
00:25:01,510 --> 00:25:00,480
does have an impact on on our on our

698
00:25:03,110 --> 00:25:01,520
human bodies

699
00:25:07,029 --> 00:25:03,120
but it is something that we can mitigate

700
00:25:10,470 --> 00:25:09,110
well that's all we have time for today

701
00:25:12,870 --> 00:25:10,480
thank you nikki also

702
00:25:15,269 --> 00:25:12,880
and jake for joining us and thank you

703
00:25:18,390 --> 00:25:15,279
for submitting your excellent questions

704
00:25:19,990 --> 00:25:18,400
for more information visit nasa.gov

705
00:25:21,990 --> 00:25:20,000
sun earth where you can read more about

706
00:25:24,230 --> 00:25:22,000
today's announcement and watch videos

707
00:25:25,990 --> 00:25:24,240
that dive deeper into the science

708
00:25:28,310 --> 00:25:26,000
you can also follow at nasa sun on

709
00:25:30,230 --> 00:25:28,320
twitter or at mastersonscience on

710
00:25:31,750 --> 00:25:30,240
facebook for regular updates and news

711
00:25:36,370 --> 00:25:31,760
about our star

712
00:25:36,380 --> 00:25:40,830
[Music]