1
00:00:00,000 --> 00:00:06,700
you

2
00:00:11,000 --> 00:00:09,530
good morning I med Wyler associate

3
00:00:13,129 --> 00:00:11,010
administrator for the science Mission

4
00:00:16,099 --> 00:00:13,139
Directorate I like to welcome you to

5
00:00:17,689 --> 00:00:16,109
this horse stork occasion the day many

6
00:00:20,720 --> 00:00:17,699
of us have long been waiting for to

7
00:00:23,179 --> 00:00:20,730
celebrate Hubble's new beginning I'll

8
00:00:25,040 --> 00:00:23,189
talk a little bit about that in a few

9
00:00:26,689 --> 00:00:25,050
minutes but for now I thought I'd like

10
00:00:29,390 --> 00:00:26,699
to bring you back to the path this past

11
00:00:30,980 --> 00:00:29,400
May when your main question in the media

12
00:00:33,140 --> 00:00:30,990
was when are we going to see the

13
00:00:34,850 --> 00:00:33,150

pictures we know we've had successful

14
00:00:37,340 --> 00:00:34,860
spacewalks but when will we see the

15
00:00:39,800 --> 00:00:37,350
pictures that's why we're here today to

16
00:00:43,130 --> 00:00:39,810
see the pictures and a few spectra tool

17
00:00:44,360 --> 00:00:43,140
I might add we have many dignitaries in

18
00:00:46,820 --> 00:00:44,370
the audience today to help us celebrate

19
00:00:48,410 --> 00:00:46,830
this occasion and Charlie Bolden the

20
00:00:50,180 --> 00:00:48,420
NASA Administrator will formally

21
00:00:51,950 --> 00:00:50,190
introduce them in a few minutes but one

22
00:00:54,710 --> 00:00:51,960
in particular has been in my mind a

23
00:00:57,020 --> 00:00:54,720
full-time Hubble partner these past two

24
00:00:58,520 --> 00:00:57,030
decades Senator Barbara Mikulski has

25
00:01:00,650 --> 00:00:58,530
actively supported the Hubble mission

26
00:01:02,990 --> 00:01:00,660
throughout its long history she was

27
00:01:04,939 --> 00:01:03,000
instrumental in helping to ensure this

28
00:01:07,459 --> 00:01:04,949
last servicing mission even happened and

29
00:01:09,739 --> 00:01:07,469
without her long and steadfast support

30
00:01:12,380 --> 00:01:09,749
through thick and thin we want to be

31
00:01:14,899 --> 00:01:12,390
here today I don't think there's anyone

32
00:01:17,260 --> 00:01:14,909
here or in the scientific community we

33
00:01:21,980 --> 00:01:17,270
disagree with her being given the title

34
00:01:23,929 --> 00:01:21,990
godmother to the Hubble we sincerely

35
00:01:25,609 --> 00:01:23,939
appreciate everything she's done over

36
00:01:28,219 --> 00:01:25,619
the years and supported this mission and

37
00:01:30,950 --> 00:01:28,229
NASA overall and Senator I have to

38
00:01:32,120 --> 00:01:30,960

relate one personal story you may be

39
00:01:34,539 --> 00:01:32,130
probably remember this because I

40
00:01:36,830 --> 00:01:34,549
certainly do but I was a young younger

41
00:01:39,440 --> 00:01:36,840
astronomer at NASA and I had the

42
00:01:41,179 --> 00:01:39,450
distinct honor and privilege to present

43
00:01:43,249 --> 00:01:41,189
the senator from Maryland the first

44
00:01:46,550 --> 00:01:43,259
images from the repaired hubble space

45
00:01:48,410 --> 00:01:46,560
telescope on January thirteenth 1994 and

46
00:01:50,359 --> 00:01:48,420
a little room in Greenbelt Maryland and

47
00:01:52,429 --> 00:01:50,369
I was able to give you those pictures

48
00:01:53,959 --> 00:01:52,439
and show them to you and I remember a

49
00:01:56,149 --> 00:01:53,969
comment you made when you looked at this

50
00:01:59,029 --> 00:01:56,159
one galaxy gee it's like putting my

51
00:02:00,620 --> 00:01:59,039
glasses on and then you took those

52
00:02:01,819 --> 00:02:00,630
pictures out and you held them up in

53
00:02:04,370 --> 00:02:01,829
front of the press and you uttered that

54
00:02:07,309 --> 00:02:04,380
famous quote the trouble with Hubble is

55
00:02:10,160 --> 00:02:07,319
over little did we know how prescient

56
00:02:12,559 --> 00:02:10,170
that comment was and now to another

57
00:02:14,179 --> 00:02:12,569
longtime Hubble supporter is my pleasure

58
00:02:16,910 --> 00:02:14,189
to introduce my colleague in boss

59
00:02:17,300 --> 00:02:16,920
Charlie Bolden NASA Administrator as

60
00:02:18,680 --> 00:02:17,310
many

61
00:02:21,410 --> 00:02:18,690
you know Charlie's at a long history

62
00:02:23,839 --> 00:02:21,420
with NASA he's flown into orbit four

63
00:02:26,300 --> 00:02:23,849

times aboard the Space Shuttle having

64
00:02:27,710 --> 00:02:26,310
commanded two of those missions charlize

65
00:02:29,180 --> 00:02:27,720
also been involved with Hubble for a

66
00:02:30,589 --> 00:02:29,190
long time he was one of the five

67
00:02:34,160 --> 00:02:30,599
astronauts who actually launched the

68
00:02:35,630 --> 00:02:34,170
Hubble originally in 1994 several years

69
00:02:37,610 --> 00:02:35,640
he's also served as a chair of the

70
00:02:39,170 --> 00:02:37,620
standing independent review team which

71
00:02:41,360 --> 00:02:39,180
was a critical team of outside experts

72
00:02:43,250 --> 00:02:41,370
that reviewed every step of the progress

73
00:02:46,460 --> 00:02:43,260
we made toward getting ready for this

74
00:02:48,199 --> 00:02:46,470
servicing mission and that role helped

75
00:02:50,840 --> 00:02:48,209
support the decision to go forward with

76
00:02:52,340 --> 00:02:50,850
the flight eventually Charlie has held

77
00:02:54,289 --> 00:02:52,350
several technical assignments why at

78
00:02:56,270 --> 00:02:54,299
NASA all of which have helped prep him

79
00:02:58,340 --> 00:02:56,280
for perhaps his most challenging

80
00:03:00,440 --> 00:02:58,350
position that is our new NASA

81
00:03:10,789 --> 00:03:00,450
Administrator and with that very brief

82
00:03:13,009 --> 00:03:10,799
introduction here's Charlie dance thank

83
00:03:15,770 --> 00:03:13,019
you all very much thanks dad for the

84
00:03:19,100 --> 00:03:15,780
introduction and good morning to all of

85
00:03:21,199 --> 00:03:19,110
you it's it is an incredible pleasure

86
00:03:24,170 --> 00:03:21,209
for me to be here to take part in in

87
00:03:26,960 --> 00:03:24,180
this August occasion first senator

88
00:03:29,060 --> 00:03:26,970

Mikulski I'd like to echo Ed's comments

89
00:03:32,809 --> 00:03:29,070
and also personally say welcome to you

90
00:03:34,309 --> 00:03:32,819
and to your team that's here I thank you

91
00:03:36,830 --> 00:03:34,319
for being a tremendous advocate and

92
00:03:38,270 --> 00:03:36,840
supporter of NASA and an extraordinary

93
00:03:41,300 --> 00:03:38,280
champion of our Goddard Space Flight

94
00:03:44,390 --> 00:03:41,310
Center in Greenbelt Maryland your energy

95
00:03:47,210 --> 00:03:44,400
enthusiasm and perseverance are the key

96
00:03:48,800 --> 00:03:47,220
reasons that we're here today it's truly

97
00:03:51,620 --> 00:03:48,810
an honor and a pleasure for me to be

98
00:03:53,870 --> 00:03:51,630
here with you senator if you don't mind

99
00:03:55,789 --> 00:03:53,880
before I turn the microphone over to you

100
00:03:57,559 --> 00:03:55,799
I'd like to say a few words because

101
00:04:01,490 --> 00:03:57,569
Hubble truly has a special place in my

102
00:04:05,629 --> 00:04:01,500
heart Hubble's a teachable moment in

103
00:04:07,400 --> 00:04:05,639
unparalleled teamwork it's the work of

104
00:04:11,949 --> 00:04:07,410
thousands of intrepid individuals

105
00:04:14,979 --> 00:04:11,959
including scientists managers engineers

106
00:04:19,449 --> 00:04:14,989
support staff Center personnel

107
00:04:22,820 --> 00:04:19,459
contractors international partners

108
00:04:25,250 --> 00:04:22,830
spouses at least two of whom are here

109
00:04:29,060 --> 00:04:25,260
today in fact I see several as a matter

110
00:04:30,350 --> 00:04:29,070
of fact who go unheralded but but play a

111
00:04:33,379 --> 00:04:30,360
critical role in what

112
00:04:36,709 --> 00:04:33,389
do and of course current and former

113
00:04:38,360 --> 00:04:36,719

astronauts and by my count and scooter

114
00:04:42,589 --> 00:04:38,370
you can help me here I think there were

115
00:04:45,200 --> 00:04:42,599
33 different visitors not different 33

116
00:04:46,999 --> 00:04:45,210
visitors to Hubble some of whom went

117
00:04:49,490 --> 00:04:47,009
more than once and they will go unnamed

118
00:04:55,339 --> 00:04:49,500
because I don't want anybody to to chest

119
00:04:56,719 --> 00:04:55,349
as them for their greed they have been

120
00:04:58,369 --> 00:04:56,729
the ones who were involved in putting

121
00:05:00,740 --> 00:04:58,379
Hubble into orbit and enhancing its

122
00:05:03,290 --> 00:05:00,750
capabilities with subsequent servicing

123
00:05:05,330 --> 00:05:03,300
missions these people are dedicated to

124
00:05:08,510 --> 00:05:05,340
the beliefs that space holds tremendous

125
00:05:10,610 --> 00:05:08,520
benefits for our lives on earth and the

126
00:05:13,879 --> 00:05:10,620
noblest scientific frontiers can be

127
00:05:16,129 --> 00:05:13,889
engaged from that lofty perch frankly

128
00:05:18,260 --> 00:05:16,139
I'm really excited to see everybody here

129
00:05:19,850 --> 00:05:18,270
especially the space shuttle crew that

130
00:05:22,339 --> 00:05:19,860
gave Hubble a new beginning after its

131
00:05:25,339 --> 00:05:22,349
servicing mission this past May to

132
00:05:30,290 --> 00:05:25,349
Commander Scott scooter Altman and his

133
00:05:32,390 --> 00:05:30,300
crew well done scooter you know I can't

134
00:05:35,059 --> 00:05:32,400
say enough about about the team that you

135
00:05:36,110 --> 00:05:35,069
led and you and your crew I understand

136
00:05:37,969 --> 00:05:36,120
are going to share some of your thoughts

137
00:05:41,390 --> 00:05:37,979
and the next briefing following this

138
00:05:43,969 --> 00:05:41,400

also here in the front are two of my

139
00:05:46,399 --> 00:05:43,979
former compatriots commander of STS 31

140
00:05:49,579 --> 00:05:46,409
the hubble deploy mission Colonel Lauren

141
00:05:51,740 --> 00:05:49,589
j Shriver US Air Force retired I had the

142
00:05:54,589 --> 00:05:51,750
distinct honor of being Lauren's pilot

143
00:05:57,110 --> 00:05:54,599
on the deploy mission of Hubble back in

144
00:05:59,029 --> 00:05:57,120
nineteen ninety Lauren I'm really glad

145
00:06:02,029 --> 00:05:59,039
that you are able to be here because

146
00:06:03,920 --> 00:06:02,039
it's very special mission specialist

147
00:06:06,920 --> 00:06:03,930
captain Bruce McCandless US Navy retired

148
00:06:08,869 --> 00:06:06,930
is also with us and and Bruce I want to

149
00:06:10,909 --> 00:06:08,879
thank you for your presence and and I

150
00:06:12,170 --> 00:06:10,919
will I'm going to go away from the

151
00:06:14,540 --> 00:06:12,180
script here because I want to tell a

152
00:06:16,939 --> 00:06:14,550
story about Bruce and one of our other

153
00:06:20,240 --> 00:06:16,949
mission specialists who are not here who

154
00:06:21,499 --> 00:06:20,250
is not here dr. Kathy Sullivan was going

155
00:06:24,769 --> 00:06:21,509
to be here and she'll be here later

156
00:06:26,420 --> 00:06:24,779
today but i think it is somewhat

157
00:06:30,679 --> 00:06:26,430
appropriate that she is out of the room

158
00:06:33,110 --> 00:06:30,689
and the reason i say that is because a

159
00:06:34,969 --> 00:06:33,120
little known secret about the crew was

160
00:06:37,610 --> 00:06:34,979
we had some of you will remember we had

161
00:06:39,379 --> 00:06:37,620
difficulty deploying one of the solar

162
00:06:40,879 --> 00:06:39,389
arrays on deploy day and so what was

163
00:06:43,790 --> 00:06:40,889

supposed to be like a 15-minute

164
00:06:46,129 --> 00:06:43,800
evolution turned out to be a one day

165
00:06:48,740 --> 00:06:46,139
volution to get hubble configured so

166
00:06:51,800 --> 00:06:48,750
that we could release it the decision

167
00:06:54,200 --> 00:06:51,810
was made that for contingency we would

168
00:06:57,110 --> 00:06:54,210
put and Senator Mikulski you can

169
00:06:59,629 --> 00:06:57,120
appreciate contingencies we put Bruce

170
00:07:01,430 --> 00:06:59,639
McCandless and Kathy Sullivan in the

171
00:07:04,129 --> 00:07:01,440
airlock and we started to depressurize

172
00:07:06,520 --> 00:07:04,139
the airlock and if my memory serves me

173
00:07:09,200 --> 00:07:06,530
well we were five minutes away from

174
00:07:12,260 --> 00:07:09,210
being completely depressed and opening

175
00:07:14,089 --> 00:07:12,270
the hatch and sending them outside when

176
00:07:15,980 --> 00:07:14,099
all of a sudden a young engineer from

177
00:07:17,089 --> 00:07:15,990
Goddard convinced everybody that Bruce

178
00:07:19,850 --> 00:07:17,099
McCandless knew what he was talking

179
00:07:21,980 --> 00:07:19,860
about earlier that morning when we first

180
00:07:25,520 --> 00:07:21,990
started having problems when Bruce said

181
00:07:28,219 --> 00:07:25,530
it's a tension monitoring module and we

182
00:07:31,249 --> 00:07:28,229
all went what's a tension monitoring

183
00:07:33,469 --> 00:07:31,259
module and he saw is just some software

184
00:07:35,089 --> 00:07:33,479
we put in the satellite so we wouldn't

185
00:07:37,430 --> 00:07:35,099
rip the solar arrays apart if we had a

186
00:07:39,670 --> 00:07:37,440
problem nobody paid any attention to

187
00:07:41,990 --> 00:07:39,680
Bruce because most of us usually didn't

188
00:07:43,430 --> 00:07:42,000

because we knew he was smarter than the

189
00:07:46,279 --> 00:07:43,440
rest of us and we didn't want to let him

190
00:07:47,719 --> 00:07:46,289
know that so a young engineer at Goddard

191
00:07:49,100 --> 00:07:47,729
later that afternoon said you know I

192
00:07:51,680 --> 00:07:49,110
think it's a tension monitoring module

193
00:07:53,930 --> 00:07:51,690
and if you will allow me to change

194
00:07:56,420 --> 00:07:53,940
someone's two zeros and I'm I am I am

195
00:08:00,290 --> 00:07:56,430
embellishing the story dr. Wilder it

196
00:08:07,110 --> 00:08:04,290
but we we were told that that the signal

197
00:08:10,939 --> 00:08:07,120
was sent from Goddard to to know up the

198
00:08:14,689 --> 00:08:10,949
tension monitoring module immediately

199
00:08:17,820 --> 00:08:14,699
the the wayward solar away went out I

200
00:08:21,899 --> 00:08:17,830
floated up because I was the IMAX camera

201
00:08:24,089 --> 00:08:21,909
operator donned my hefty big IMAX camera

202
00:08:25,939 --> 00:08:24,099
and started to shoot as Steve Hawley

203
00:08:28,649 --> 00:08:25,949
maneuvered Hubble for its release

204
00:08:31,170 --> 00:08:28,659
released it in Bruce and Kathy are going

205
00:08:34,050 --> 00:08:31,180
what about us what about us and we said

206
00:08:35,880 --> 00:08:34,060
just hang tight and so the two people

207
00:08:38,310 --> 00:08:35,890
who had probably worked more than anyone

208
00:08:40,199 --> 00:08:38,320
else on the crew to get hubble ready for

209
00:08:43,680 --> 00:08:40,209
deployment were locked in the air lock

210
00:08:46,380 --> 00:08:43,690
and they missed the deployment and in

211
00:08:48,720 --> 00:08:46,390
fact it was like an hour or so later

212
00:08:50,759 --> 00:08:48,730
when we were able to go re pressurize

213
00:08:52,259 --> 00:08:50,769

and let them out but they're not a lot

214
00:08:54,660 --> 00:08:52,269
of people that knew that story so once

215
00:08:57,750 --> 00:08:54,670
again Kathy is missing from the

216
00:09:00,030 --> 00:08:57,760
unveiling here but I'm certain that

217
00:09:01,769 --> 00:09:00,040
we'll be okay our other crew member who

218
00:09:03,329 --> 00:09:01,779
is unfortunately not here is dr. Steve

219
00:09:05,759 --> 00:09:03,339
Hawley who actually released Hubble from

220
00:09:07,319 --> 00:09:05,769
the shuttles robot arm he had a

221
00:09:10,079 --> 00:09:07,329
previously scheduled Hubble in-game

222
00:09:11,970 --> 00:09:10,089
engagement we all agreed that it that

223
00:09:13,740 --> 00:09:11,980
would complement today's event and so he

224
00:09:16,110 --> 00:09:13,750
gets to give Hubble give Hubble hugs

225
00:09:17,460 --> 00:09:16,120
from elsewhere Hubble's launching March

226
00:09:19,340 --> 00:09:17,470
the most significant advance in

227
00:09:21,900 --> 00:09:19,350
astronomy since Galileo's telescope

228
00:09:23,670 --> 00:09:21,910
after almost 20 years of service our

229
00:09:26,490 --> 00:09:23,680
view of the universe and our place

230
00:09:28,439 --> 00:09:26,500
within it will never be the same we're

231
00:09:31,199 --> 00:09:28,449
also nearing the culmination of the

232
00:09:33,449 --> 00:09:31,209
international year of astronomy a global

233
00:09:35,730 --> 00:09:33,459
celebration of the telescope telescopic

234
00:09:39,120 --> 00:09:35,740
exploration of the heavens begun by

235
00:09:41,370 --> 00:09:39,130
Galileo 400 years ago I'm sure I speak

236
00:09:43,530 --> 00:09:41,380
for all the servicing mission crews and

237
00:09:46,740 --> 00:09:43,540
certainly for my fellow crew members of

238
00:09:49,079 --> 00:09:46,750

STS 31 when I say that after almost 20

239
00:09:50,699 --> 00:09:49,089
years of service we are so proud and

240
00:09:53,639 --> 00:09:50,709
honored to have been a part of the

241
00:09:55,980 --> 00:09:53,649
Hubble story we await new chapters being

242
00:09:57,389 --> 00:09:55,990
written with a telescope that following

243
00:09:59,130 --> 00:09:57,399
the last servicing mission is

244
00:10:01,650 --> 00:09:59,140
significantly more powerful than ever

245
00:10:03,990 --> 00:10:01,660
and equipped to last well into the next

246
00:10:05,910 --> 00:10:04,000
decade Hubble is one of the most

247
00:10:09,720 --> 00:10:05,920
accomplished scientific instruments ever

248
00:10:11,569 --> 00:10:09,730
created indeed the this great instrument

249
00:10:13,680 --> 00:10:11,579
has captured the imagination of people

250
00:10:15,150 --> 00:10:13,690
everywhere

251
00:10:18,000 --> 00:10:15,160
actually the youth across our great

252
00:10:21,210 --> 00:10:18,010
nation and around the world everyone

253
00:10:22,860 --> 00:10:21,220
knows how important it is to me for NASA

254
00:10:26,520 --> 00:10:22,870
to inspire the next generation of

255
00:10:28,590 --> 00:10:26,530
explorers and now it's my sincere

256
00:10:32,040 --> 00:10:28,600
pleasure to turn the microphone over to

257
00:10:34,500 --> 00:10:32,050
the one and only as he had stated Hubble

258
00:10:36,450 --> 00:10:34,510
godmother the Honorable senator from

259
00:10:47,580 --> 00:10:36,460
Maryland our friend Senator Barbara

260
00:10:50,480 --> 00:10:47,590
Mikulski chemicals good morning

261
00:10:53,460 --> 00:10:50,490
everybody I'm really happy to be here

262
00:10:55,770 --> 00:10:53,470
with all of you and as you can see I

263
00:10:57,930 --> 00:10:55,780

very clearly know the difference now

264
00:11:01,200 --> 00:10:57,940
between a hard landing and a soft

265
00:11:04,080 --> 00:11:01,210
landing I have one of these great space

266
00:11:08,760 --> 00:11:04,090
boots on I feel like I'm half of an

267
00:11:13,770 --> 00:11:08,770
astronaut here but uh right after you

268
00:11:16,620 --> 00:11:13,780
all landed so did I uh but I took a fall

269
00:11:18,810 --> 00:11:16,630
coming out of church I'm sure God had a

270
00:11:20,640 --> 00:11:18,820
message for me he waited till I finished

271
00:11:22,770 --> 00:11:20,650
church before he sent me that message

272
00:11:26,340 --> 00:11:22,780
but I'm very pleased to be here today

273
00:11:28,410 --> 00:11:26,350
for this very exciting a set of videos

274
00:11:30,320 --> 00:11:28,420
that we're going to see for the Hubble

275
00:11:32,940 --> 00:11:30,330
new beginning I want to thank

276
00:11:36,840 --> 00:11:32,950
administrator Bolden and it's great to

277
00:11:39,300 --> 00:11:36,850
be here at the NASA headquarters like

278
00:11:42,210 --> 00:11:39,310
administrator Bolden I really want to

279
00:11:44,190 --> 00:11:42,220
congratulate all of you the reason we're

280
00:11:47,370 --> 00:11:44,200
going to see the Hubble new beginning is

281
00:11:50,160 --> 00:11:47,380
because all of us in this room and many

282
00:11:52,740 --> 00:11:50,170
around this country and many around the

283
00:11:54,930 --> 00:11:52,750
world have been part of team Hubble that

284
00:11:58,079 --> 00:11:54,940
have helped design Hubble fix Hubble

285
00:12:02,040 --> 00:11:58,089
launched Hubble keep Hubble operating um

286
00:12:04,770 --> 00:12:02,050
and I want to like you administrator

287
00:12:08,130 --> 00:12:04,780
bold and pay tribute to them of course

288
00:12:10,710 --> 00:12:08,140

I'm very proud of my home team town team

289
00:12:13,020 --> 00:12:10,720
of the Goddard Space Flight Center which

290
00:12:16,140 --> 00:12:13,030
is in charge of Hubble's daily

291
00:12:19,079 --> 00:12:16,150
operations I'm very excited about the

292
00:12:22,320 --> 00:12:19,089
Space Telescope Institute in maryland

293
00:12:25,200 --> 00:12:22,330
where Hubble where Goddard is the

294
00:12:27,600 --> 00:12:25,210
catcher's mitt for those fantastic rays

295
00:12:29,630 --> 00:12:27,610
that are coming from the telescope

296
00:12:32,790 --> 00:12:29,640
is it to the Space Telescope Institute

297
00:12:36,389 --> 00:12:32,800
to then translate it into scientific

298
00:12:39,030 --> 00:12:36,399
information that goes global very few

299
00:12:41,519 --> 00:12:39,040
people realize that what we have done

300
00:12:43,769 --> 00:12:41,529
with Hubble is one of the greatest forms

301
00:12:45,780 --> 00:12:43,779
of public diplomacy that the United

302
00:12:48,000 --> 00:12:45,790
States has people can talk about

303
00:12:50,100 --> 00:12:48,010
Fulbright fellows they can invite

304
00:12:53,250 --> 00:12:50,110
students from around the world to come

305
00:12:56,130 --> 00:12:53,260
and study with us what I really support

306
00:12:59,699 --> 00:12:56,140
but what we do with Hubble and much of

307
00:13:02,519 --> 00:12:59,709
what we do at NASA is open and public

308
00:13:05,550 --> 00:13:02,529
and given to the world and the world

309
00:13:09,269 --> 00:13:05,560
looks forward to us when it comes to

310
00:13:11,639 --> 00:13:09,279
space we are the indispensable nation we

311
00:13:14,400 --> 00:13:11,649
thank our international partners for

312
00:13:16,290 --> 00:13:14,410
what they do every day and Space Station

313
00:13:20,519 --> 00:13:16,300

and the wonderful things that they do

314
00:13:22,920 --> 00:13:20,529
but we really are the information we

315
00:13:25,500 --> 00:13:22,930
give really does help with new

316
00:13:27,900 --> 00:13:25,510
scientific discovery and scientific

317
00:13:30,120 --> 00:13:27,910
inspiration I want to thank the ground

318
00:13:32,460 --> 00:13:30,130
crew at the Kennedy Space Center and the

319
00:13:35,670 --> 00:13:32,470
Johnson Space Center where astronauts

320
00:13:38,280 --> 00:13:35,680
trained and launch and do all the things

321
00:13:41,250 --> 00:13:38,290
that enable them to blast off from the

322
00:13:44,100 --> 00:13:41,260
shuttle to go to make sure that Hubble

323
00:13:47,069 --> 00:13:44,110
continued to be foot for duty over these

324
00:13:49,680 --> 00:13:47,079
non gears in a particular tribute to the

325
00:13:52,740 --> 00:13:49,690
astronauts and to the people who love

326
00:13:54,720 --> 00:13:52,750
them and by the way we all love them for

327
00:13:57,420 --> 00:13:54,730
their heroic feats during the many

328
00:14:00,000 --> 00:13:57,430
marathon spacewalks for their patients

329
00:14:02,759 --> 00:14:00,010
their dedication their duty driven

330
00:14:05,340 --> 00:14:02,769
approach when with what there were

331
00:14:07,860 --> 00:14:05,350
considerable delays one where we going

332
00:14:10,380 --> 00:14:07,870
to have Hubble at all word and then even

333
00:14:13,050 --> 00:14:10,390
during this launch period so I just want

334
00:14:15,960 --> 00:14:13,060
to say not only in behalf of myself and

335
00:14:19,050 --> 00:14:15,970
not only in behalf of the Senate and the

336
00:14:21,420 --> 00:14:19,060
Congress but I want to say in behalf the

337
00:14:24,300 --> 00:14:21,430
American people Thank you Thank You

338
00:14:28,199 --> 00:14:24,310

astronauts Thank You team Hubble because

339
00:14:31,319 --> 00:14:28,209
you keep America flying in a way that

340
00:14:34,079 --> 00:14:31,329
inspires all of us Hubble is really

341
00:14:37,199 --> 00:14:34,089
important to us into the world I've had

342
00:14:40,100 --> 00:14:37,209
a long history with Hubble and it's been

343
00:14:42,980 --> 00:14:40,110
a roller coaster ride

344
00:14:45,290 --> 00:14:42,990
when we first heard about Hubble I heard

345
00:14:47,920 --> 00:14:45,300
about it not only through budget memos

346
00:14:51,079 --> 00:14:47,930
and where I became the new chair of the

347
00:14:54,280 --> 00:14:51,089
then the VA HUD bill but I was fortunate

348
00:14:57,889 --> 00:14:54,290
to have to space senators said uh

349
00:14:59,930 --> 00:14:57,899
senator Jake Garn and Senator John Glenn

350
00:15:02,840 --> 00:14:59,940
and they said you know we love the

351
00:15:04,509 --> 00:15:02,850
astronauts we lost human spaceflight but

352
00:15:09,170 --> 00:15:04,519
we're going to be doing things in

353
00:15:11,389 --> 00:15:09,180
technology that will be will change the

354
00:15:14,060 --> 00:15:11,399
paradigm about how we think about the

355
00:15:17,660 --> 00:15:14,070
universe well I saw the Hubble get

356
00:15:20,690 --> 00:15:17,670
launched I was so excited then we waited

357
00:15:24,970 --> 00:15:20,700
and then we waited and then it was

358
00:15:29,019 --> 00:15:24,980
really a fuzzy fuzzy picture but

359
00:15:32,630 --> 00:15:29,029
steadfast we launched the new mirror

360
00:15:36,139 --> 00:15:32,640
that fixed Hubble I said it was the most

361
00:15:41,120 --> 00:15:36,149
expensive contact lens in world history

362
00:15:43,639 --> 00:15:41,130
in 1993 we gave Hubble a new opportunity

363
00:15:46,160 --> 00:15:43,649

but also what we demonstrated and

364
00:15:48,710 --> 00:15:46,170
installing that new contact lens in

365
00:15:51,470 --> 00:15:48,720
space was that by the way the astronauts

366
00:15:54,019 --> 00:15:51,480
could do it they then could do the space

367
00:15:56,600 --> 00:15:54,029
station had the astronauts not been able

368
00:15:58,939 --> 00:15:56,610
to repair the Hubble we knew that they

369
00:16:00,800 --> 00:15:58,949
could not then build the space station

370
00:16:04,060 --> 00:16:00,810
in the sky while our wonderful

371
00:16:10,220 --> 00:16:04,070
astronauts went back time and time again

372
00:16:12,920 --> 00:16:10,230
1997 1999 2002 all each time giving

373
00:16:16,600 --> 00:16:12,930
Hubble new batteries and new technology

374
00:16:19,189 --> 00:16:16,610
then we all know the story in 2004

375
00:16:21,590 --> 00:16:19,199
administrator O'Keefe cancelled the

376
00:16:24,769 --> 00:16:21,600
Hubble and was concerned about the

377
00:16:26,990 --> 00:16:24,779
safety of the astronauts we understood

378
00:16:30,530 --> 00:16:27,000
that but when I reached out to him and

379
00:16:34,939 --> 00:16:30,540
said this you know when someone gets a

380
00:16:37,490 --> 00:16:34,949
terrible diagnosis and they think it's

381
00:16:40,519 --> 00:16:37,500
going to be the end for them they get a

382
00:16:46,639 --> 00:16:40,529
second opinion would you at least allow

383
00:16:48,920 --> 00:16:46,649
a second opinion on the Hubble and he

384
00:16:51,620 --> 00:16:48,930
said yes

385
00:16:54,260 --> 00:16:51,630
much is said about administrator O'Keefe

386
00:16:57,320 --> 00:16:54,270
canceling the Hubble but I want to talk

387
00:17:00,710 --> 00:16:57,330
about administer administrator okey be

388
00:17:03,500 --> 00:17:00,720

willing and open minded and generous to

389
00:17:06,110 --> 00:17:03,510
say let's have that second opinion well

390
00:17:08,179 --> 00:17:06,120
the second opinion said that going to

391
00:17:10,429 --> 00:17:08,189
Hubble would be no dangerous than any

392
00:17:12,590 --> 00:17:10,439
other mission I then met with the

393
00:17:15,890 --> 00:17:12,600
astronauts and ask them why do they risk

394
00:17:19,520 --> 00:17:15,900
their lives because this is a voluntary

395
00:17:21,620 --> 00:17:19,530
assignment they said they wanted to do

396
00:17:23,660 --> 00:17:21,630
that scientific breakthrough remember

397
00:17:26,059 --> 00:17:23,670
that marvelous lunch we had on Capitol

398
00:17:29,450 --> 00:17:26,069
Hill with my colleagues and that's what

399
00:17:32,270 --> 00:17:29,460
they did well when i saw this space

400
00:17:34,370 --> 00:17:32,280
launch and watched you all yet give it

401
00:17:37,010 --> 00:17:34,380
another set of scientific instruments

402
00:17:39,290 --> 00:17:37,020
another set of batteries I was

403
00:17:40,790 --> 00:17:39,300
completely thrilled but you need to know

404
00:17:43,940 --> 00:17:40,800
that one of the great things about

405
00:17:46,430 --> 00:17:43,950
Hubble is its inspiration not only its

406
00:17:48,080 --> 00:17:46,440
scientific breakthroughs and information

407
00:17:50,780 --> 00:17:48,090
and I want to tell you a little story

408
00:17:54,049 --> 00:17:50,790
that a constituent told me I watched the

409
00:17:56,240 --> 00:17:54,059
spacewalk I held my breath I saw you

410
00:17:59,810 --> 00:17:56,250
pull this stuff out I saw you out there

411
00:18:02,030 --> 00:17:59,820
for a long time and believe me anybody

412
00:18:06,169 --> 00:18:02,040
in politics noise would have liked to go

413
00:18:07,970 --> 00:18:06,179

for maybe oxygen for a long time and uh

414
00:18:11,060 --> 00:18:07,980
be tethered but here's what this

415
00:18:13,910 --> 00:18:11,070
constituent told me this story uh he has

416
00:18:17,330 --> 00:18:13,920
a little boy for that watched with him

417
00:18:20,000 --> 00:18:17,340
the nasa channel and all of the walking

418
00:18:21,740 --> 00:18:20,010
he loves mechanical things and they said

419
00:18:23,419 --> 00:18:21,750
oh the astronauts are doing this and

420
00:18:24,650 --> 00:18:23,429
they're doing this one the shuttle

421
00:18:26,540 --> 00:18:24,660
they're doing this on the shuttle

422
00:18:28,970 --> 00:18:26,550
meantime his two-year-old sisters

423
00:18:30,919 --> 00:18:28,980
walking around lorig like we do they

424
00:18:33,320 --> 00:18:30,929
don't always know what we're doing but

425
00:18:36,919 --> 00:18:33,330
she was taking it all in so flash

426
00:18:39,620 --> 00:18:36,929
forward uh there is a senior citizen

427
00:18:42,940 --> 00:18:39,630
picnic but you had to be bused in and

428
00:18:45,590 --> 00:18:42,950
they said Oh we'll meet pop up at the

429
00:18:49,010 --> 00:18:45,600
parking lot and we'll go to the picnic

430
00:18:51,950 --> 00:18:49,020
on the shuttle she was very excited and

431
00:18:55,160 --> 00:18:51,960
off they went so they get to the parking

432
00:18:58,159 --> 00:18:55,170
lot everybody is doing lined up to get

433
00:19:00,290 --> 00:18:58,169
on the bus and she starts to cry she

434
00:19:02,100 --> 00:19:00,300
doesn't want to get on the bus she wants

435
00:19:03,900 --> 00:19:02,110
to get on the shuttle

436
00:19:06,960 --> 00:19:03,910
this little girl thought she was going

437
00:19:11,820 --> 00:19:06,970
to take a rocket ship with her

438
00:19:16,680 --> 00:19:11,830

grandfather to a picnic someday right

439
00:19:18,630 --> 00:19:16,690
this says the impact you never know

440
00:19:21,360 --> 00:19:18,640
what's going on in the minds of these

441
00:19:24,090 --> 00:19:21,370
children and on another note and I'll

442
00:19:27,510 --> 00:19:24,100
can really conclude with a story one

443
00:19:30,660 --> 00:19:27,520
another note one of the things that also

444
00:19:33,299 --> 00:19:30,670
inspired me and others was the fact that

445
00:19:35,940 --> 00:19:33,309
dr. wyler then worked with the

446
00:19:38,820 --> 00:19:35,950
Smithsonian to develop an astronomy book

447
00:19:43,110 --> 00:19:38,830
for blind children it has been now

448
00:19:46,430 --> 00:19:43,120
published by the Smithsonian it is you

449
00:19:49,680 --> 00:19:46,440
they use the pictures of the Hubble in

450
00:19:53,909 --> 00:19:49,690
Braille the way they can do this and

451
00:19:57,930 --> 00:19:53,919
it's called touch the invisible sky so

452
00:20:01,020 --> 00:19:57,940
to all who had a role in Hubble to all

453
00:20:04,289 --> 00:20:01,030
that enables all children to be able to

454
00:20:07,230 --> 00:20:04,299
participate today we're going to see new

455
00:20:09,600 --> 00:20:07,240
pictures where because of all of you we

456
00:20:11,909 --> 00:20:09,610
were able to touch the invisible sky I'm

457
00:20:14,100 --> 00:20:11,919
so glad to have been part of it and you

458
00:20:16,860 --> 00:20:14,110
can count on me to continue to support

459
00:20:18,840 --> 00:20:16,870
NASA we're going to keep forward we're

460
00:20:21,810 --> 00:20:18,850
going to it's not about budgets line

461
00:20:24,419 --> 00:20:21,820
items or memos it's about science it's

462
00:20:26,610 --> 00:20:24,429
about technology it's about discovery

463
00:20:28,980 --> 00:20:26,620

it's about our American character and

464
00:22:27,250 --> 00:20:28,990
about the future of our children god

465
00:22:33,230 --> 00:22:30,610
with that brief unveiling of our images

466
00:22:34,520 --> 00:22:33,240
I'd like to now start the part of the

467
00:22:36,400 --> 00:22:34,530
press conference we're going to get some

468
00:22:39,080 --> 00:22:36,410
scientists to talk about what they mean

469
00:22:40,730 --> 00:22:39,090
with me on this panel our four

470
00:22:42,560 --> 00:22:40,740
distinguished scientists but they

471
00:22:45,290 --> 00:22:42,570
represent hundreds of scientists

472
00:22:47,450 --> 00:22:45,300
engineers astronauts and other support

473
00:22:50,450 --> 00:22:47,460
people that have worked diligently over

474
00:22:52,820 --> 00:22:50,460
the last 30 years to keep Hubble working

475
00:22:55,910 --> 00:22:52,830
at its peak efficiency now I'd like to

476
00:22:57,710 --> 00:22:55,920
introduce them on my far right and from

477
00:23:00,290 --> 00:22:57,720
the University of Virginia is dr. Bob

478
00:23:02,240 --> 00:23:00,300
O'Connell chair of the science Oversight

479
00:23:05,240 --> 00:23:02,250
Committee for the wide field camera 3

480
00:23:07,310 --> 00:23:05,250
one of our new instruments to an

481
00:23:09,740 --> 00:23:07,320
immediate right is dr. James green

482
00:23:11,510 --> 00:23:09,750
cosmic origins spectrograph principal

483
00:23:14,560 --> 00:23:11,520
investigator from the University of

484
00:23:17,870 --> 00:23:14,570
Colorado in Boulder I my immediate left

485
00:23:20,390 --> 00:23:17,880
Dave will Kron a 30-year veteran of

486
00:23:22,010 --> 00:23:20,400
Hubble like myself he's Goddard's senior

487
00:23:24,710 --> 00:23:22,020
project scientist for Hubble in

488
00:23:27,080 --> 00:23:24,720

Greenbelt Maryland and I my far left is

489
00:23:29,360 --> 00:23:27,090
dr. Heidi Hammel senior research

490
00:23:32,900 --> 00:23:29,370
scientist at the Space Science Institute

491
00:23:34,340 --> 00:23:32,910
also in Boulder Colorado before I hand

492
00:23:36,380 --> 00:23:34,350
over the mic I'd like to say a few words

493
00:23:38,060 --> 00:23:36,390
first I've been with the Hubble program

494
00:23:40,700 --> 00:23:38,070
for about 30 years and watched the

495
00:23:43,040 --> 00:23:40,710
program mature quite a bit as many of

496
00:23:44,780 --> 00:23:43,050
you know all the servicing missions were

497
00:23:47,120 --> 00:23:44,790
filled with edge-of-the-seat excitement

498
00:23:49,400 --> 00:23:47,130
the world watched as our astronaut team

499
00:23:51,830 --> 00:23:49,410
some thirty two astronauts individual

500
00:23:53,720 --> 00:23:51,840
astronauts over the years work to work

501
00:23:56,000 --> 00:23:53,730
their magic to keep Hubble alive and

502
00:23:58,280 --> 00:23:56,010
none was more exciting than the last

503
00:23:59,870 --> 00:23:58,290
servicing mission number four which is

504
00:24:02,660 --> 00:23:59,880
actually number five but we won't get

505
00:24:06,080 --> 00:24:02,670
into that the astronaut team led by

506
00:24:08,720 --> 00:24:06,090
Scott scooter Altman installed two new

507
00:24:10,610 --> 00:24:08,730
instruments what was most amazing to me

508
00:24:14,090 --> 00:24:10,620
was repaired two instruments that were

509
00:24:15,950 --> 00:24:14,100
dead literally dead and they took them

510
00:24:18,290 --> 00:24:15,960
apart put some new circuit boards then

511
00:24:20,300 --> 00:24:18,300
put it back together again I've how many

512
00:24:22,100 --> 00:24:20,310
hundreds of screws and somehow they

513
00:24:23,810 --> 00:24:22,110

brought them alive I as I told some

514
00:24:25,070 --> 00:24:23,820
reporter this morning if they had just

515
00:24:26,840 --> 00:24:25,080
fixed one of them I would have been

516
00:24:29,090 --> 00:24:26,850
amazed they fixed both of them and

517
00:24:31,340 --> 00:24:29,100
you'll see some of that data today and

518
00:24:33,370 --> 00:24:31,350
they replaced jaros batteries blankets

519
00:24:35,720 --> 00:24:33,380
and other odds and ends for good measure

520
00:24:37,130 --> 00:24:35,730
bottom line these professionals left

521
00:24:38,549 --> 00:24:37,140
Hubble as a new state-of-the-art

522
00:24:40,769 --> 00:24:38,559
telescope

523
00:24:42,269 --> 00:24:40,779
this is the fifth time now new beginning

524
00:24:44,940 --> 00:24:42,279
this is the fifth time we've had a new

525
00:24:47,279 --> 00:24:44,950
telescope up there capable of continuing

526
00:24:49,739 --> 00:24:47,289
its historic scientific journey for at

527
00:24:52,320 --> 00:24:49,749
least five more years and I will bet a

528
00:24:53,759 --> 00:24:52,330
long time after that I was telling a

529
00:24:55,139 --> 00:24:53,769
reporter this morning that i'm not good

530
00:24:57,149 --> 00:24:55,149
at predictions because i was up here

531
00:24:58,440 --> 00:24:57,159
many years ago predicting that spirit

532
00:25:02,519 --> 00:24:58,450
and opportunity with the last three

533
00:25:04,049 --> 00:25:02,529
months and that was five years ago so so

534
00:25:05,669 --> 00:25:04,059
jet as you saw in the unveiling the

535
00:25:07,259 --> 00:25:05,679
instruments aboard hubble are capable of

536
00:25:09,029 --> 00:25:07,269
taking amazing images and the world

537
00:25:11,220 --> 00:25:09,039
stands ready to see what we can do from

538
00:25:13,109 --> 00:25:11,230

this point on and let there be no doubt

539
00:25:15,539 --> 00:25:13,119
that this is truly a Hubble's new

540
00:25:20,009 --> 00:25:15,549
beginning with that turn to Bob to tell

541
00:25:21,419 --> 00:25:20,019
us what he's got Thanks then let me

542
00:25:24,029 --> 00:25:21,429
first say that we couldn't be happier

543
00:25:25,230 --> 00:25:24,039
about the way things of God you recall

544
00:25:28,230 --> 00:25:25,240
the installation of the wide field

545
00:25:30,330 --> 00:25:28,240
camera was a little touch-and-go but I'm

546
00:25:31,919 --> 00:25:30,340
happy to say it's working beautifully at

547
00:25:34,139 --> 00:25:31,929
the moment it's working even a little

548
00:25:36,210 --> 00:25:34,149
better than we expected right now it's

549
00:25:38,009 --> 00:25:36,220
scheduled to be used in half of all the

550
00:25:40,950 --> 00:25:38,019
Hubble observations over the next year

551
00:25:43,830 --> 00:25:40,960
and we think a larger fraction over the

552
00:25:46,470 --> 00:25:43,840
next five years so we really want to

553
00:25:49,200 --> 00:25:46,480
thank the wonderful crew of Atlantis for

554
00:25:51,330 --> 00:25:49,210
what they did for us and especially John

555
00:25:53,460 --> 00:25:51,340
Andrew I think it's safe to say that

556
00:25:56,279 --> 00:25:53,470
never have so many scientists about so

557
00:25:59,970 --> 00:25:56,289
much to two guys who fixed a stuck bolt

558
00:26:02,310 --> 00:25:59,980
thank you very much guys we have four

559
00:26:04,409 --> 00:26:02,320
pictures for you today we're going to

560
00:26:06,180 --> 00:26:04,419
show these in order from old age to

561
00:26:07,799 --> 00:26:06,190
youth but it's good to keep in mind that

562
00:26:11,340 --> 00:26:07,809
astronomers think that something is a

563
00:26:14,310 --> 00:26:11,350

that's a million years old is young so

564
00:26:16,200 --> 00:26:14,320
let's start with the first picture this

565
00:26:17,940 --> 00:26:16,210
is a picture of a gigantic star cluster

566
00:26:20,399 --> 00:26:17,950
in our own galaxy it's called Omega

567
00:26:22,109 --> 00:26:20,409
Centauri it contains about 10 million

568
00:26:25,080 --> 00:26:22,119
stars and we're only seeing a very small

569
00:26:27,419 --> 00:26:25,090
piece of it here these are all old stars

570
00:26:30,269 --> 00:26:27,429
they're about twice as old as the Sun

571
00:26:33,029 --> 00:26:30,279
and you can see they fall into three

572
00:26:34,950 --> 00:26:33,039
different color classes they're gold

573
00:26:36,180 --> 00:26:34,960
stars and in fact most of the stars in

574
00:26:38,009 --> 00:26:36,190
the image are gold and that's the color

575
00:26:40,649 --> 00:26:38,019
of the Sun but then there are very blue

576
00:26:42,359 --> 00:26:40,659
stars and they're very red ones now the

577
00:26:45,419 --> 00:26:42,369
color contrast here is real and it's

578
00:26:48,090 --> 00:26:45,429
picked up by our camera the blue stars

579
00:26:49,710 --> 00:26:48,100
are very hot they emit lot most of their

580
00:26:51,299 --> 00:26:49,720
light in the ultraviolet part of the

581
00:26:51,960 --> 00:26:51,309
spectrum that's one of the new bands we

582
00:26:54,690 --> 00:26:51,970
have on

583
00:26:57,480 --> 00:26:54,700
camera but very little in the red band

584
00:26:59,940 --> 00:26:57,490
and the cool stars are just the opposite

585
00:27:03,090 --> 00:26:59,950
they made a lot of light in the red band

586
00:27:04,440 --> 00:27:03,100
but very little in the ultraviolet so

587
00:27:07,170 --> 00:27:04,450
just by looking at the colors of the

588
00:27:08,790 --> 00:27:07,180

stars in this kind of picture you can

589
00:27:10,440 --> 00:27:08,800
sort them by temperature and in this

590
00:27:13,620 --> 00:27:10,450
particular case it also means sorting

591
00:27:15,060 --> 00:27:13,630
them by evolutionary state because the

592
00:27:16,890 --> 00:27:15,070
temperature differences here are caused

593
00:27:19,350 --> 00:27:16,900
by differences in the internal structure

594
00:27:22,050 --> 00:27:19,360
of these stars and in the kinds of fuels

595
00:27:23,550 --> 00:27:22,060
are burning deep inside of them so by

596
00:27:25,830 --> 00:27:23,560
studying pictures like this we learn

597
00:27:28,680 --> 00:27:25,840
about the physics of stars as they

598
00:27:31,610 --> 00:27:28,690
approach very very old age now the

599
00:27:34,020 --> 00:27:31,620
second picture is called the butterfly

600
00:27:37,020 --> 00:27:34,030
nebula for obvious reasons it looks like

601
00:27:39,330 --> 00:27:37,030
a butterfly this is also a star in old

602
00:27:41,310 --> 00:27:39,340
age but it's gone beyond the stage of

603
00:27:43,980 --> 00:27:41,320
the stars you just saw and it's now

604
00:27:45,600 --> 00:27:43,990
beginning to lose its outer envelope of

605
00:27:48,690 --> 00:27:45,610
gas which is drifting back off into

606
00:27:50,850 --> 00:27:48,700
space and that's being lit up by the

607
00:27:53,340 --> 00:27:50,860
radiation from the collapsing star

608
00:27:55,530 --> 00:27:53,350
that's left behind now in this picture

609
00:27:58,260 --> 00:27:55,540
we took advantage of the special filters

610
00:28:00,870 --> 00:27:58,270
on the new camera to isolate the light

611
00:28:02,760 --> 00:28:00,880
of five different elements and they've

612
00:28:04,740 --> 00:28:02,770
been color-coded separately here so for

613
00:28:09,720 --> 00:28:04,750

example the red in this image is

614
00:28:11,220 --> 00:28:09,730
nitrogen gas and the blue is oxygen what

615
00:28:13,100 --> 00:28:11,230
you're seeing here is a critical phase

616
00:28:15,120 --> 00:28:13,110
in what you might call galactic ecology

617
00:28:16,650 --> 00:28:15,130
it's the it's the point at which

618
00:28:18,900 --> 00:28:16,660
material that's been chemically

619
00:28:21,420 --> 00:28:18,910
processed inside of stars is returned

620
00:28:25,650 --> 00:28:21,430
back into space where it can form new

621
00:28:28,140 --> 00:28:25,660
stars new planets and in fact life on

622
00:28:30,840 --> 00:28:28,150
many of those planets in this particular

623
00:28:33,200 --> 00:28:30,850
kind of star much of the carbon that is

624
00:28:36,560 --> 00:28:33,210
in our bodies and in other life-forms is

625
00:28:39,600 --> 00:28:36,570
produced and recycled into the galaxy

626
00:28:42,360 --> 00:28:39,610
the third picture is the only one of

627
00:28:44,130 --> 00:28:42,370
something outside our galaxy is a group

628
00:28:47,220 --> 00:28:44,140
of other galaxies that is called

629
00:28:49,830 --> 00:28:47,230
Stephan's quintet it's about 300 million

630
00:28:51,270 --> 00:28:49,840
light years away now the name comes from

631
00:28:54,480 --> 00:28:51,280
the fact that you can see there are five

632
00:28:55,770 --> 00:28:54,490
bright galaxies in that field four of

633
00:28:58,620 --> 00:28:55,780
them are actually close together in

634
00:29:00,570 --> 00:28:58,630
space but the fifth one is just

635
00:29:03,570 --> 00:29:00,580
accidentally along a line of sight to

636
00:29:05,570 --> 00:29:03,580
the others it's nearer to us and you can

637
00:29:09,450 --> 00:29:05,580
tell which one that is

638
00:29:11,159 --> 00:29:09,460

thanks to the beautiful resolution of

639
00:29:12,360 --> 00:29:11,169
the camera because it's the one it's the

640
00:29:14,249 --> 00:29:12,370
one in the upper left here in the

641
00:29:16,820 --> 00:29:14,259
picture of the blue galaxy you can see

642
00:29:20,490 --> 00:29:16,830
the individual stars in that galaxy

643
00:29:22,110 --> 00:29:20,500
thanks to the camera the other galaxies

644
00:29:23,879 --> 00:29:22,120
are eight times farther away and they're

645
00:29:26,340 --> 00:29:23,889
too far away to see the individual stars

646
00:29:29,310 --> 00:29:26,350
now all the blue stuff you see in this

647
00:29:31,320 --> 00:29:29,320
picture is young by our standards that

648
00:29:33,870 --> 00:29:31,330
means it's between ten and a hundred

649
00:29:35,730 --> 00:29:33,880
million years old in this case the four

650
00:29:37,710 --> 00:29:35,740
yellowish galaxies you see in the frame

651
00:29:39,480 --> 00:29:37,720
are gravitationally interacting with

652
00:29:40,919 --> 00:29:39,490
each other they're pulling together and

653
00:29:42,899 --> 00:29:40,929
you can see that material has been

654
00:29:45,149 --> 00:29:42,909
pulled out sort of like taffy from some

655
00:29:47,159 --> 00:29:45,159
of these and there's a spray of blue

656
00:29:48,690 --> 00:29:47,169
stars right in the center there which

657
00:29:50,310 --> 00:29:48,700
has been produced by the fact that one

658
00:29:52,649 --> 00:29:50,320
galaxy is running into another there

659
00:29:55,230 --> 00:29:52,659
this kind of an interaction is a normal

660
00:29:57,180 --> 00:29:55,240
step in galaxies building and we

661
00:29:59,519 --> 00:29:57,190
expected over time long stretches of

662
00:30:04,019 --> 00:29:59,529
time those four galaxies will eventually

663
00:30:05,460 --> 00:30:04,029

merge into a single big galaxy now for

664
00:30:11,759 --> 00:30:05,470
the last picture we're back in our own

665
00:30:14,909 --> 00:30:11,769
galaxy this is a cloud of dense material

666
00:30:17,850 --> 00:30:14,919
which is being bombarded by radiation

667
00:30:19,200 --> 00:30:17,860
and intense radiation from surrounding

668
00:30:20,970 --> 00:30:19,210
stars you don't see the surrounding

669
00:30:23,700 --> 00:30:20,980
stars they're out of the field but

670
00:30:26,279 --> 00:30:23,710
they're bombarding the star or the cloud

671
00:30:27,899 --> 00:30:26,289
in the center and that radiation is

672
00:30:31,110 --> 00:30:27,909
having two effects first of all it's

673
00:30:32,940 --> 00:30:31,120
evaporating even disrupting the outer

674
00:30:35,220 --> 00:30:32,950
parts of this cloud and that's what

675
00:30:37,619 --> 00:30:35,230
produces the filament restructure you

676
00:30:40,399 --> 00:30:37,629
see there the green and the blue colors

677
00:30:44,100 --> 00:30:40,409
and at the same time the radiation is

678
00:30:47,249 --> 00:30:44,110
compressing the cloud and inducing new

679
00:30:49,529 --> 00:30:47,259
star formation inside of it we call this

680
00:30:51,840 --> 00:30:49,539
triggered star formation and it happens

681
00:30:53,430 --> 00:30:51,850
all the time now the young stars are

682
00:30:55,289 --> 00:30:53,440
being formed there you cannot see in

683
00:30:58,560 --> 00:30:55,299
this picture because in this particular

684
00:31:00,749 --> 00:30:58,570
color band the cloud is opaque but if

685
00:31:03,450 --> 00:31:00,759
you go to the new infrared band that our

686
00:31:05,549 --> 00:31:03,460
camera provides you can see inside the

687
00:31:07,409 --> 00:31:05,559
cloud and so if we could go to that this

688
00:31:09,570 --> 00:31:07,419

is going to be a dissolve from this

689
00:31:12,240 --> 00:31:09,580
picture which is taken in the normal

690
00:31:15,149 --> 00:31:12,250
visible bands to one taken in the

691
00:31:17,750 --> 00:31:15,159
infrared and what you'll see is that the

692
00:31:18,870 --> 00:31:17,760
cloud disappears to a kind of ghost-like

693
00:31:21,840 --> 00:31:18,880
appearance

694
00:31:23,850 --> 00:31:21,850
you see lots more stars for the bright

695
00:31:26,220 --> 00:31:23,860
ones in the direction of the cloud our

696
00:31:27,660 --> 00:31:26,230
young stars inside that cloud and one of

697
00:31:30,600 --> 00:31:27,670
them the one more or less in the center

698
00:31:31,980 --> 00:31:30,610
of the picture has these Jets coming out

699
00:31:34,170 --> 00:31:31,990
of it you can see these beautiful long

700
00:31:37,500 --> 00:31:34,180
Jets coming out that's material being

701
00:31:39,840 --> 00:31:37,510
blasted at very high velocity out from

702
00:31:42,030 --> 00:31:39,850
what's going to be probably a planetary

703
00:31:45,090 --> 00:31:42,040
system by the time this thing settles

704
00:31:46,800 --> 00:31:45,100
down and we only see these kinds of

705
00:31:48,840 --> 00:31:46,810
activities in stars that are about a

706
00:31:50,450 --> 00:31:48,850
hundred thousand years old so what

707
00:31:53,340 --> 00:31:50,460
you're seeing here is a very energetic

708
00:31:56,250 --> 00:31:53,350
infant star being formed deep inside

709
00:31:58,830 --> 00:31:56,260
this clap now based on these pictures

710
00:32:00,690 --> 00:31:58,840
and the other data we get so far we're

711
00:32:02,880 --> 00:32:00,700
fully confident the camera is working as

712
00:32:04,200 --> 00:32:02,890
it was intended to work and we're

713
00:32:06,150 --> 00:32:04,210

eagerly looking forward to see what

714
00:32:08,880 --> 00:32:06,160
other astronomers are going to do with

715
00:32:10,920 --> 00:32:08,890
it over the next five years and I will

716
00:32:12,930 --> 00:32:10,930
turn it over to Jim Green who's going to

717
00:32:15,000 --> 00:32:12,940
tell you something about a different

718
00:32:17,970 --> 00:32:15,010
dimension of capability with Hubble

719
00:32:19,740 --> 00:32:17,980
thank you Bob I'm going to present the

720
00:32:21,750 --> 00:32:19,750
first results from the cosmic origins

721
00:32:23,100 --> 00:32:21,760
spectrograph the other new instrument

722
00:32:25,470 --> 00:32:23,110
that was installed during servicing

723
00:32:28,170 --> 00:32:25,480
mission for the cosmic origins

724
00:32:30,210 --> 00:32:28,180
spectrograph will I call it cos doesn't

725
00:32:32,400 --> 00:32:30,220
take pictures in the usual sense it's a

726
00:32:34,620 --> 00:32:32,410
spectrograph and records the spectrum of

727
00:32:36,540 --> 00:32:34,630
light from objects breaking that light

728
00:32:38,790 --> 00:32:36,550
up into its constituent colours which

729
00:32:40,890 --> 00:32:38,800
the way a prism makes a rainbow but with

730
00:32:42,930 --> 00:32:40,900
much greater precision so that we can

731
00:32:44,730 --> 00:32:42,940
actually make quantitative evaluations

732
00:32:47,490 --> 00:32:44,740
of what the physics that's going on in

733
00:32:49,950 --> 00:32:47,500
the objects we look at now because every

734
00:32:52,530 --> 00:32:49,960
element in every chemical compound in

735
00:32:54,660 --> 00:32:52,540
the universe has a unique spectral

736
00:32:56,250 --> 00:32:54,670
signature it absorbs certain energies of

737
00:32:58,410 --> 00:32:56,260
light and doesn't interact with other

738
00:33:00,030 --> 00:32:58,420

energies of light when we measure those

739
00:33:02,250 --> 00:33:00,040
energies of light we can tell what

740
00:33:04,410 --> 00:33:02,260
chemicals are present where they are how

741
00:33:07,140 --> 00:33:04,420
hot they are how fast they're moving and

742
00:33:08,880 --> 00:33:07,150
we can see the physics of the objects

743
00:33:10,830 --> 00:33:08,890
that's going on as well as the physics

744
00:33:12,660 --> 00:33:10,840
of the gas that the light might pass

745
00:33:14,250 --> 00:33:12,670
through all the way traveling towards us

746
00:33:17,910 --> 00:33:14,260
as an example of this kind of

747
00:33:23,100 --> 00:33:17,920
observation my first slide is a spectrum

748
00:33:25,080 --> 00:33:23,110
of a quasar notice parks 0405 the this

749
00:33:27,150 --> 00:33:25,090
object is about seven billion light

750
00:33:30,000 --> 00:33:27,160
years away and so even at the resolution

751
00:33:31,770 --> 00:33:30,010
of Hubble it just looks like a dot okay

752
00:33:32,669 --> 00:33:31,780
but it's really a giant galaxy probably

753
00:33:36,960 --> 00:33:32,679
with a giant black hole

754
00:33:38,399 --> 00:33:36,970
the center and millions of stars worth

755
00:33:39,989 --> 00:33:38,409
the material falling into that black

756
00:33:41,549 --> 00:33:39,999
hole creating an enormous amount of

757
00:33:43,470 --> 00:33:41,559
light but it's so far away it's just

758
00:33:46,139 --> 00:33:43,480
adopt but when we take a spectrum which

759
00:33:48,389 --> 00:33:46,149
is the red line shown there and the

760
00:33:49,889 --> 00:33:48,399
variations are all caused by different

761
00:33:51,629 --> 00:33:49,899
chemicals in the quasar and different

762
00:33:53,789 --> 00:33:51,639
chemicals along the line of sight

763
00:33:55,680 --> 00:33:53,799

towards us we can begin to understand

764
00:33:58,259 --> 00:33:55,690
the physics that's going on here for

765
00:34:00,239 --> 00:33:58,269
example we've listed down there IgM

766
00:34:02,759 --> 00:34:00,249
filament one in filament 2 that sends

767
00:34:05,129 --> 00:34:02,769
for filaments in the intergalactic

768
00:34:07,289 --> 00:34:05,139
medium we believe that most of the

769
00:34:09,180 --> 00:34:07,299
matter of space in the universe is

770
00:34:11,280 --> 00:34:09,190
actually in wispy filaments and the

771
00:34:12,659 --> 00:34:11,290
voids between the galaxies but they

772
00:34:14,369 --> 00:34:12,669
don't make enough light to be seen by

773
00:34:16,349 --> 00:34:14,379
taking picture they have to be inferred

774
00:34:17,879 --> 00:34:16,359
their existence by their effect as the

775
00:34:19,230 --> 00:34:17,889
light travels through them and that's

776
00:34:21,359 --> 00:34:19,240
what we're seeing here and we're not

777
00:34:23,460 --> 00:34:21,369
only seeing hydrogen the most common

778
00:34:24,809 --> 00:34:23,470
element universe we're seeing oxygen as

779
00:34:26,750 --> 00:34:24,819
well and in fact not labeled here we

780
00:34:29,280 --> 00:34:26,760
also see things like carbon and nitrogen

781
00:34:31,319 --> 00:34:29,290
so the elements of life are being

782
00:34:32,819 --> 00:34:31,329
produced in stars like a picture we saw

783
00:34:34,319 --> 00:34:32,829
earlier but they're also being

784
00:34:35,819 --> 00:34:34,329
distributed throughout the cosmos and

785
00:34:37,889 --> 00:34:35,829
not just locally but even into

786
00:34:39,419 --> 00:34:37,899
intergalactic space and this is one of

787
00:34:42,750 --> 00:34:39,429
the great mysteries we have currently

788
00:34:44,609 --> 00:34:42,760

about understanding the cosmos is how do

789
00:34:49,409 --> 00:34:44,619
these get so far away from the stars

790
00:34:51,180 --> 00:34:49,419
that actually produce them now the great

791
00:34:53,220 --> 00:34:51,190
new ability of cos that we brought up

792
00:34:54,960 --> 00:34:53,230
here is that this spectrum was taken in

793
00:34:57,720 --> 00:34:54,970
less than one tenth the time it would

794
00:34:59,039 --> 00:34:57,730
have previously taken with Hubble the

795
00:35:00,780 --> 00:34:59,049
new instrument is ten times more

796
00:35:03,450 --> 00:35:00,790
sensitive which means we can look at 10

797
00:35:05,190 --> 00:35:03,460
times as many targets or alternatively a

798
00:35:07,410 --> 00:35:05,200
target that's one-tenth is bright and

799
00:35:09,299 --> 00:35:07,420
get that science and what that means is

800
00:35:11,010 --> 00:35:09,309
we can start to build up a catalog of

801
00:35:12,690 --> 00:35:11,020
the locations of all these wisps of gas

802
00:35:14,579 --> 00:35:12,700
through the intergalactic medium and

803
00:35:15,930 --> 00:35:14,589
instead of having a handful of subs

804
00:35:18,180 --> 00:35:15,940
observations we're going to have

805
00:35:19,829 --> 00:35:18,190
hundreds even thousands of observations

806
00:35:21,299 --> 00:35:19,839
and we're going to be able to start to

807
00:35:23,370 --> 00:35:21,309
build up a map of how matters

808
00:35:24,870 --> 00:35:23,380
distributed in the cosmos and this is

809
00:35:26,339 --> 00:35:24,880
one of the most fundamental questions we

810
00:35:28,289 --> 00:35:26,349
have about the nature of the universe is

811
00:35:30,150 --> 00:35:28,299
how did matter wind up structured

812
00:35:31,740 --> 00:35:30,160
through the universe the way it is it

813
00:35:34,200 --> 00:35:31,750

started out smooth today it's very

814
00:35:36,030 --> 00:35:34,210
clumpy it's mostly in stars and galaxies

815
00:35:39,030 --> 00:35:36,040
that we see how did it get that way over

816
00:35:43,650 --> 00:35:39,040
the evolution of cosmic time now the

817
00:35:45,120 --> 00:35:43,660
second image we have is a spectrum taken

818
00:35:46,500 --> 00:35:45,130
of a supernova remnant in the Large

819
00:35:48,990 --> 00:35:46,510
Magellanic Cloud

820
00:35:50,730 --> 00:35:49,000
and so this is a star that exploded and

821
00:35:52,050 --> 00:35:50,740
the wisp that the picture in the upper

822
00:35:53,850 --> 00:35:52,060
corner was taken with wide field camera

823
00:35:56,310 --> 00:35:53,860
3 and the bright little rings represent

824
00:35:58,560 --> 00:35:56,320
out flowing gas from the exploded star

825
00:36:00,600 --> 00:35:58,570
and we looked at a particular not that

826
00:36:02,370 --> 00:36:00,610
we know had a lot of oxygen in it and

827
00:36:04,650 --> 00:36:02,380
took a spectrum of that and we're able

828
00:36:06,600 --> 00:36:04,660
to actually identify then the amount of

829
00:36:08,670 --> 00:36:06,610
oxygen and carbon and also it's not

830
00:36:10,200 --> 00:36:08,680
labeled here but silicon in the system

831
00:36:12,330 --> 00:36:10,210
and this tells us about the chemistry of

832
00:36:13,710 --> 00:36:12,340
how these stars explode how the matter

833
00:36:15,630 --> 00:36:13,720
gets distributed between them it even

834
00:36:18,090 --> 00:36:15,640
tells us about how the star operated

835
00:36:21,000 --> 00:36:18,100
prior to its explosion because explosion

836
00:36:22,650 --> 00:36:21,010
occurs in the winds that the star blew

837
00:36:24,000 --> 00:36:22,660
out beforehand so all that interacting

838
00:36:26,400 --> 00:36:24,010

you can start to understand that physics

839
00:36:28,530 --> 00:36:26,410
and once again understand how did these

840
00:36:30,900 --> 00:36:28,540
chemicals congregate eventually into

841
00:36:34,290 --> 00:36:30,910
planets and life and questions that we

842
00:36:37,530 --> 00:36:34,300
have we're all concerned about finally

843
00:36:40,260 --> 00:36:37,540
our my third images of markarian 817 to

844
00:36:41,490 --> 00:36:40,270
nearby active galaxies an active galaxy

845
00:36:43,650 --> 00:36:41,500
means that the light coming to this

846
00:36:45,540 --> 00:36:43,660
galaxy is predominantly coming from

847
00:36:47,340 --> 00:36:45,550
something other than just the stars in

848
00:36:48,990 --> 00:36:47,350
the galaxy there's more life being

849
00:36:51,300 --> 00:36:49,000
produced by some other physical process

850
00:36:52,860 --> 00:36:51,310
than by all the stars put together again

851
00:36:54,750 --> 00:36:52,870
we assume that that's a black hole the

852
00:36:56,760 --> 00:36:54,760
center of the galaxy with enormous

853
00:36:58,470 --> 00:36:56,770
amounts of material falling in heating

854
00:37:00,510 --> 00:36:58,480
up making a lot of light a small amount

855
00:37:02,940 --> 00:37:00,520
of it being shot out as jets and his

856
00:37:05,310 --> 00:37:02,950
globules um just the way the gravity

857
00:37:06,930 --> 00:37:05,320
interacts in these processes so what we

858
00:37:09,360 --> 00:37:06,940
show here is a spectrum that was taken

859
00:37:11,250 --> 00:37:09,370
in 1997 in the blue line with the

860
00:37:12,870 --> 00:37:11,260
Goddard high resolution spectrograph

861
00:37:16,650 --> 00:37:12,880
which was the spectrograph onboard

862
00:37:18,660 --> 00:37:16,660
Hubble at that time and in 2009 with cos

863
00:37:19,890 --> 00:37:18,670

and you can see the spectral look pretty

864
00:37:21,300 --> 00:37:19,900
much the same one of the things we

865
00:37:22,560 --> 00:37:21,310
wanted to do was to calibrate the

866
00:37:24,810 --> 00:37:22,570
instrument with his observation to make

867
00:37:27,390 --> 00:37:24,820
sure was working properly but this

868
00:37:29,640 --> 00:37:27,400
observation took only nine percent of

869
00:37:31,500 --> 00:37:29,650
the observing time that it took in 1997

870
00:37:33,060 --> 00:37:31,510
so again we become a much more powerful

871
00:37:35,400 --> 00:37:33,070
instrument and able to get much more

872
00:37:37,680 --> 00:37:35,410
data also that's the entire spectrum

873
00:37:39,690 --> 00:37:37,690
from 1997 but that's only one eighth of

874
00:37:42,150 --> 00:37:39,700
the spectrum that we collected in 2009

875
00:37:43,890 --> 00:37:42,160
it runs off the page four times as long

876
00:37:45,780 --> 00:37:43,900
at both directions one of the

877
00:37:48,500 --> 00:37:45,790
interesting things to note as denoted

878
00:37:51,300 --> 00:37:48,510
there by the red mark is that one of the

879
00:37:54,840 --> 00:37:51,310
features in the spectrum in 1997 is now

880
00:37:57,030 --> 00:37:54,850
absent this was a blob of grass blown

881
00:37:58,890 --> 00:37:57,040
out by the black hole that the light was

882
00:37:59,940 --> 00:37:58,900
passing through that his now since moved

883
00:38:02,730 --> 00:37:59,950
out of the way

884
00:38:04,350 --> 00:38:02,740
and in fact it is no longer visible to

885
00:38:05,550 --> 00:38:04,360
our instrument in this time and I just

886
00:38:06,900 --> 00:38:05,560
think it's sort of interesting to note

887
00:38:08,580 --> 00:38:06,910
that we're looking at something millions

888
00:38:10,920 --> 00:38:08,590

of light-years away the size of a galaxy

889
00:38:13,020 --> 00:38:10,930
and yet over 12 years we can see how

890
00:38:14,490 --> 00:38:13,030
it's fundamentally changed and that the

891
00:38:16,410 --> 00:38:14,500
cosmos I mean though it's billions of

892
00:38:19,260 --> 00:38:16,420
years old still operates on human

893
00:38:21,420 --> 00:38:19,270
timescales I'll just wrap up by saying

894
00:38:22,920 --> 00:38:21,430
that the goal of cos was to build an

895
00:38:25,050 --> 00:38:22,930
instrument ten times more powerful than

896
00:38:26,490 --> 00:38:25,060
the previous capabilities and I'm

897
00:38:29,490 --> 00:38:26,500
pleased to announce that we've succeeded

898
00:38:31,680 --> 00:38:29,500
in that goal and I'm looking forward to

899
00:38:33,210 --> 00:38:31,690
getting lots of observations in the next

900
00:38:34,740 --> 00:38:33,220
coming years and I agree with dr. Wilder

901
00:38:36,720 --> 00:38:34,750
that we've got a good ten years to go

902
00:38:38,610 --> 00:38:36,730
but with that I passive on to Dave

903
00:38:42,030 --> 00:38:38,620
leckrone senior project scientist for

904
00:38:43,830 --> 00:38:42,040
HST thank you Jim good morning Bob and

905
00:38:46,290 --> 00:38:43,840
Jim have described some of the early

906
00:38:48,060 --> 00:38:46,300
observations acquired with our two brand

907
00:38:50,670 --> 00:38:48,070
new instruments which extend Hubble's

908
00:38:52,470 --> 00:38:50,680
observing power by factors of 10 and

909
00:38:54,510 --> 00:38:52,480
these are very high technology

910
00:38:58,860 --> 00:38:54,520
instruments and are performing superbly

911
00:39:00,690 --> 00:38:58,870
in both cases another unique aspect of

912
00:39:03,330 --> 00:39:00,700
this mission however was the attempt to

913
00:39:05,190 --> 00:39:03,340

repair two very valuable instruments

914
00:39:07,590 --> 00:39:05,200
very valuable assets that had failed

915
00:39:09,900 --> 00:39:07,600
electronically space telescope imaging

916
00:39:11,790 --> 00:39:09,910
spectrograph which failed in 2004 and

917
00:39:14,790 --> 00:39:11,800
the advanced camera for surveys which

918
00:39:17,700 --> 00:39:14,800
failed in 2007 in both cases because of

919
00:39:20,040 --> 00:39:17,710
electronic short circuits so a bold

920
00:39:21,390 --> 00:39:20,050
initiative was undertaken and involved

921
00:39:23,460 --> 00:39:21,400
tremendous effort on the part of the

922
00:39:24,750 --> 00:39:23,470
crew working with our engineers and

923
00:39:26,520 --> 00:39:24,760
designers on the ground the bold

924
00:39:28,920 --> 00:39:26,530
initiative was undertaken to attempt to

925
00:39:31,530 --> 00:39:28,930
repair both instruments and i agree with

926
00:39:33,630 --> 00:39:31,540
added going into the mission we realized

927
00:39:36,060 --> 00:39:33,640
we are attempting to repairs if we could

928
00:39:37,920 --> 00:39:36,070
get at least one of those to be

929
00:39:40,440 --> 00:39:37,930
successful then that would be a good

930
00:39:42,780 --> 00:39:40,450
outcome for the mission what we really

931
00:39:45,600 --> 00:39:42,790
never dare dream of was the possibility

932
00:39:46,800 --> 00:39:45,610
that actually both repairs might work so

933
00:39:49,260 --> 00:39:46,810
I'm here to report to you today that

934
00:39:51,270 --> 00:39:49,270
both are working splendidly and I'd like

935
00:39:52,590 --> 00:39:51,280
to show you observations taken since the

936
00:39:54,570 --> 00:39:52,600
servicing mission with both of the

937
00:39:57,600 --> 00:39:54,580
repaired instruments so if I may have

938
00:40:00,210 --> 00:39:57,610

the first graphic please okay what you

939
00:40:02,430 --> 00:40:00,220
see here is a representation of two

940
00:40:04,860 --> 00:40:02,440
different observations on the Left

941
00:40:07,800 --> 00:40:04,870
there's a picture of an image taken with

942
00:40:10,140 --> 00:40:07,810
Hubble many years ago of an exploding a

943
00:40:12,720 --> 00:40:10,150
very highly active star called a de

944
00:40:13,560 --> 00:40:12,730
Carini and this star is actually two

945
00:40:16,110 --> 00:40:13,570
stars very may

946
00:40:17,760 --> 00:40:16,120
stars orbiting around each other in some

947
00:40:19,080 --> 00:40:17,770
cases they it's ones in a highly

948
00:40:20,760 --> 00:40:19,090
elliptical orbit around the other and

949
00:40:22,710 --> 00:40:20,770
they come close to each other these

950
00:40:24,420 --> 00:40:22,720
stars are so massive they burn their

951
00:40:26,220 --> 00:40:24,430
energy very rapidly and they're not

952
00:40:28,380 --> 00:40:26,230
going to last very long their lifetimes

953
00:40:30,480 --> 00:40:28,390
are short sometime within the next

954
00:40:31,950 --> 00:40:30,490
hundred thousand years or so this system

955
00:40:34,290 --> 00:40:31,960
of two very massive stars is going to

956
00:40:36,480 --> 00:40:34,300
blow up it's going to become a massive

957
00:40:38,430 --> 00:40:36,490
supernova possibly a gamma-ray burster

958
00:40:40,830 --> 00:40:38,440
it's going to be an intensely energetic

959
00:40:43,350 --> 00:40:40,840
object and it's only 7,500 light-years

960
00:40:45,780 --> 00:40:43,360
away from the earth the nice thing is at

961
00:40:47,130 --> 00:40:45,790
that distance we think we're protected

962
00:40:49,560 --> 00:40:47,140
so we don't have to worry too much about

963
00:40:51,180 --> 00:40:49,570

the impact but astronomers within the

964
00:40:52,680 --> 00:40:51,190
next hundred thousand years or so are

965
00:40:54,120 --> 00:40:52,690
going to have the opportunity to observe

966
00:40:55,080 --> 00:40:54,130
and ordinary people are going to have

967
00:40:57,270 --> 00:40:55,090
the opportunity to observe an

968
00:40:59,850 --> 00:40:57,280
extraordinary flash of light in the sky

969
00:41:01,320 --> 00:40:59,860
and to study it now what you see coming

970
00:41:03,150 --> 00:41:01,330
off to the right there is the new

971
00:41:05,070 --> 00:41:03,160
observation with the space telescope

972
00:41:07,590 --> 00:41:05,080
imaging spectrograph there's that long

973
00:41:09,870 --> 00:41:07,600
dark slit that you can place over the

974
00:41:12,330 --> 00:41:09,880
the image of the object and you can

975
00:41:15,030 --> 00:41:12,340
collect light point by point along that

976
00:41:16,920 --> 00:41:15,040
slit and at each of those points the

977
00:41:19,350 --> 00:41:16,930
light is spread out into its component

978
00:41:21,420 --> 00:41:19,360
colors and you can see a spectrum that

979
00:41:23,880 --> 00:41:21,430
corresponds to each spatial point along

980
00:41:27,210 --> 00:41:23,890
the slit and in this particular case

981
00:41:28,920 --> 00:41:27,220
this was taken last June the two stars

982
00:41:30,420 --> 00:41:28,930
had just passed through their moment of

983
00:41:34,920 --> 00:41:30,430
closest approach and there was a lot of

984
00:41:37,200 --> 00:41:34,930
energetic activity happening I talked to

985
00:41:38,610 --> 00:41:37,210
Massey Mike Massimino on the rest of the

986
00:41:40,290 --> 00:41:38,620
crew before the mission and I said one

987
00:41:42,330 --> 00:41:40,300
of the things we really need to do we've

988
00:41:44,550 --> 00:41:42,340

been monitoring this baby it's so

989
00:41:47,820 --> 00:41:44,560
dynamic energetic we've been monitoring

990
00:41:49,770 --> 00:41:47,830
this since 1997 and then we had to stop

991
00:41:52,530 --> 00:41:49,780
in 2004 and we haven't been able to

992
00:41:55,050 --> 00:41:52,540
continue the story and and so now in

993
00:41:56,730 --> 00:41:55,060
fact thanks to you guys we're back up

994
00:41:58,710 --> 00:41:56,740
and running and the story continues that

995
00:42:00,480 --> 00:41:58,720
we can continue to monitor how this star

996
00:42:02,010 --> 00:42:00,490
is changing over time and look at its

997
00:42:03,990 --> 00:42:02,020
dynamics and get some understanding of

998
00:42:06,150 --> 00:42:04,000
how someday in the future this is going

999
00:42:08,040 --> 00:42:06,160
to become a really spectacular fireworks

1000
00:42:10,170 --> 00:42:08,050
show in the sky so that's the space

1001
00:42:13,560 --> 00:42:10,180
telescope imaging spectrograph story the

1002
00:42:16,500 --> 00:42:13,570
next image please okay this is a cluster

1003
00:42:19,710 --> 00:42:16,510
of galaxies called a bell 370 it's about

1004
00:42:21,870 --> 00:42:19,720
five billion years away from us it's a

1005
00:42:23,700 --> 00:42:21,880
group of galaxies large and small that

1006
00:42:26,010 --> 00:42:23,710
are all gathered together and held

1007
00:42:26,830 --> 00:42:26,020
together by gravity in particular to

1008
00:42:29,200 --> 00:42:26,840
held together by the

1009
00:42:31,210 --> 00:42:29,210
gravity of dark matter that's within the

1010
00:42:32,950 --> 00:42:31,220
cluster it's it's not just the luminous

1011
00:42:35,290 --> 00:42:32,960
matter in the galaxy as you see but

1012
00:42:36,820 --> 00:42:35,300
there's about five times more material

1013
00:42:39,400 --> 00:42:36,830

that's cold dark matter that we don't

1014
00:42:41,560 --> 00:42:39,410
really understand what it is but this

1015
00:42:43,600 --> 00:42:41,570
all this material together exerts enough

1016
00:42:46,990 --> 00:42:43,610
of a gravitational force that it can

1017
00:42:48,670 --> 00:42:47,000
bend light as Einstein predicted in his

1018
00:42:50,470 --> 00:42:48,680
general theory of relativity so the

1019
00:42:53,350 --> 00:42:50,480
light from galaxies that are beyond this

1020
00:42:54,820 --> 00:42:53,360
cluster our light rays are bent as they

1021
00:42:57,130 --> 00:42:54,830
pass through the cluster and come to us

1022
00:42:58,570 --> 00:42:57,140
and they're focused like a crude lens so

1023
00:43:00,790 --> 00:42:58,580
this is called gravitational lensing

1024
00:43:03,010 --> 00:43:00,800
this particular cluster was one of the

1025
00:43:05,200 --> 00:43:03,020
early examples of this that astronomers

1026
00:43:06,850 --> 00:43:05,210
came to understand as an illustration of

1027
00:43:09,220 --> 00:43:06,860
how Einsteins gravitational lensing

1028
00:43:11,110 --> 00:43:09,230
works and in fact you see that long

1029
00:43:13,540 --> 00:43:11,120
bright arc up in the upper right it was

1030
00:43:15,640 --> 00:43:13,550
known back in the 1980s that that was an

1031
00:43:17,560 --> 00:43:15,650
example of a gravitational lens the

1032
00:43:19,660 --> 00:43:17,570
power of Hubble though is that we can

1033
00:43:22,000 --> 00:43:19,670
see incredible detail in that art so if

1034
00:43:24,190 --> 00:43:22,010
I may have the last image and rut and

1035
00:43:26,500 --> 00:43:24,200
it's rotated 90 degrees and we've zoomed

1036
00:43:27,910 --> 00:43:26,510
in so this is really fascinating to me

1037
00:43:30,820 --> 00:43:27,920
I've never seen anything quite like this

1038
00:43:33,700 --> 00:43:30,830

before this is a gravitationally lensed

1039
00:43:36,670 --> 00:43:33,710
image of a single spiral galaxy that's

1040
00:43:39,460 --> 00:43:36,680
like twice as far away from us as the

1041
00:43:40,900 --> 00:43:39,470
intervening cluster and so and we call

1042
00:43:43,810 --> 00:43:40,910
this the dragon just because it kind of

1043
00:43:45,670 --> 00:43:43,820
looks cute in that sense but on the left

1044
00:43:47,290 --> 00:43:45,680
side you see an image of the galaxy

1045
00:43:48,640 --> 00:43:47,300
quite detail with a lot of color

1046
00:43:51,490 --> 00:43:48,650
information in it that we've never seen

1047
00:43:53,350 --> 00:43:51,500
before we had taken this image and then

1048
00:43:55,480 --> 00:43:53,360
up on the upper right you see an image

1049
00:43:56,950 --> 00:43:55,490
the tail so that's the head of the

1050
00:43:58,480 --> 00:43:56,960
Dragon and the tail in the upper right

1051
00:44:00,850 --> 00:43:58,490
which is an image of the very same

1052
00:44:02,980 --> 00:44:00,860
galaxy and in between you see the

1053
00:44:04,720 --> 00:44:02,990
stretched out band of light each which

1054
00:44:07,330 --> 00:44:04,730
really is comprised of stretched out

1055
00:44:10,000 --> 00:44:07,340
images three or four additional images

1056
00:44:11,590 --> 00:44:10,010
of this same galaxy and this is what I'm

1057
00:44:14,350 --> 00:44:11,600
is just remarkable that gravitational

1058
00:44:16,810 --> 00:44:14,360
lensing can do and in particular this is

1059
00:44:18,220 --> 00:44:16,820
nature's telescope this is in taking the

1060
00:44:20,320 --> 00:44:18,230
power of Hubble and enhancing it

1061
00:44:21,960 --> 00:44:20,330
tremendously with gravitational lensing

1062
00:44:23,830 --> 00:44:21,970
so that we can actually study detailed

1063
00:44:26,110 --> 00:44:23,840

structures in galaxies that are

1064
00:44:28,060 --> 00:44:26,120
incredibly far away another thing I can

1065
00:44:29,800 --> 00:44:28,070
say is we don't see normally you might

1066
00:44:31,330 --> 00:44:29,810
see a counter example of this on the

1067
00:44:32,830 --> 00:44:31,340
other side of the cluster you don't see

1068
00:44:34,780 --> 00:44:32,840
that and that tells us that the very

1069
00:44:36,160 --> 00:44:34,790
particular special way that the dark

1070
00:44:39,810 --> 00:44:36,170
matter is distributed within that

1071
00:44:42,030 --> 00:44:39,820
cluster so I'm proud to report

1072
00:44:44,400 --> 00:44:42,040
that prior to this mission we with our

1073
00:44:46,980 --> 00:44:44,410
instrument failures we were down to

1074
00:44:50,190 --> 00:44:46,990
three operating channels instrument

1075
00:44:52,140 --> 00:44:50,200
channels on Hubble today we have 13 we

1076
00:44:54,480 --> 00:44:52,150
have six operate fully operating

1077
00:44:56,370 --> 00:44:54,490
instruments today I say fully operating

1078
00:44:58,620 --> 00:44:56,380
one of them the Nick moss has just come

1079
00:45:00,210 --> 00:44:58,630
back online we still in the process of

1080
00:45:02,310 --> 00:45:00,220
checking it out and it'll be again at

1081
00:45:04,800 --> 00:45:02,320
science program a little bit later but

1082
00:45:07,740 --> 00:45:04,810
in addition to the instruments I'm not

1083
00:45:15,720 --> 00:45:07,750
able to report any failure or problem on

1084
00:45:17,130 --> 00:45:15,730
the spacecraft itself so I I know it was

1085
00:45:20,160 --> 00:45:17,140
a tough mission and I know there are a

1086
00:45:21,960 --> 00:45:20,170
lot of travails but somehow someway you

1087
00:45:23,910 --> 00:45:21,970
guys pulled it off you just refuse to

1088
00:45:26,700 --> 00:45:23,920

say die and you kept going and we have a

1089
00:45:29,070 --> 00:45:26,710
fully functioning beautifully operating

1090
00:45:30,480 --> 00:45:29,080
Hubble Space Telescope today so with

1091
00:45:32,370 --> 00:45:30,490
that I'd like to turn it over for some

1092
00:45:34,860 --> 00:45:32,380
closing comments are nearly closing

1093
00:45:36,960 --> 00:45:34,870
comments to Heidi Hammel thanks Dave it

1094
00:45:39,540 --> 00:45:36,970
is a wonderful coincidence that

1095
00:45:41,850 --> 00:45:39,550
servicing mission for occurred in 2009

1096
00:45:45,150 --> 00:45:41,860
because as administrator Bolden already

1097
00:45:47,880 --> 00:45:45,160
said 2009 is the international year of

1098
00:45:51,540 --> 00:45:47,890
astronomy this is the year we celebrate

1099
00:45:53,370 --> 00:45:51,550
the 400th anniversary of Galileo turning

1100
00:45:55,500 --> 00:45:53,380
his telescope to the skies and

1101
00:45:58,530 --> 00:45:55,510
revolutionizing our understanding of the

1102
00:46:02,000 --> 00:45:58,540
cosmos the Hubble Space Telescope in a

1103
00:46:05,010 --> 00:46:02,010
sense represents 400 years of

1104
00:46:07,590 --> 00:46:05,020
technological innovation Hubble's

1105
00:46:10,490 --> 00:46:07,600
contribution to astronomical research is

1106
00:46:13,740 --> 00:46:10,500
its ability to provide truly unique

1107
00:46:16,620 --> 00:46:13,750
observations the new equipment installed

1108
00:46:19,410 --> 00:46:16,630
during the very successful mission by

1109
00:46:22,890 --> 00:46:19,420
the astronauts not only restores Hubble

1110
00:46:25,410 --> 00:46:22,900
to its full operational mode Hubble's

1111
00:46:27,270 --> 00:46:25,420
new cameras and spectrographs propel us

1112
00:46:30,030 --> 00:46:27,280
forward into a new beginning for

1113
00:46:31,860 --> 00:46:30,040

astronomy and astrophysics Hubble's new

1114
00:46:35,280 --> 00:46:31,870
capabilities were tested quite

1115
00:46:37,920 --> 00:46:35,290
dramatically and unexpectedly just seven

1116
00:46:39,600 --> 00:46:37,930
weeks ago seven weeks ago we got a

1117
00:46:43,200 --> 00:46:39,610
report in the middle of the night that

1118
00:46:45,030 --> 00:46:43,210
something had hit Jupiter and once we

1119
00:46:48,000 --> 00:46:45,040
convinced ourselves that that was in

1120
00:46:52,290 --> 00:46:48,010
fact correct all telescopes around the

1121
00:46:53,490 --> 00:46:52,300
world turned to Jupiter and the question

1122
00:46:57,560 --> 00:46:53,500
that I grappled with

1123
00:47:01,440 --> 00:46:57,570
well what about Hubble 15 years ago

1124
00:47:03,780 --> 00:47:01,450
exactly 15 years ago when a shattered

1125
00:47:06,510 --> 00:47:03,790
comet shoemaker-levy 9 had crashed into

1126
00:47:09,360 --> 00:47:06,520
jupiter hubble was at the forefront of

1127
00:47:12,660 --> 00:47:09,370
the observations and i had been at the

1128
00:47:15,330 --> 00:47:12,670
helm of the hubble team so could we do

1129
00:47:17,610 --> 00:47:15,340
it again the trouble was that the

1130
00:47:20,490 --> 00:47:17,620
astronauts had just finished their

1131
00:47:24,410 --> 00:47:20,500
servicing mission and the hubble team

1132
00:47:27,930 --> 00:47:24,420
was deep into what they call smooth

1133
00:47:30,210 --> 00:47:27,940
servicing mission orbital verification

1134
00:47:33,300 --> 00:47:30,220
this orbital verification is an

1135
00:47:36,360 --> 00:47:33,310
extremely important part of the mission

1136
00:47:39,680 --> 00:47:36,370
no science is being done but all the

1137
00:47:42,450 --> 00:47:39,690
instruments are being checked calibrated

1138
00:47:44,580 --> 00:47:42,460

exercise so that we can make sure that

1139
00:47:46,680 --> 00:47:44,590
the telescope is fully functioning and

1140
00:47:49,200 --> 00:47:46,690
well understood so that when they turn

1141
00:47:50,790 --> 00:47:49,210
it over to the astronomers they get the

1142
00:47:54,390 --> 00:47:50,800
good data that they really want to do

1143
00:47:58,970 --> 00:47:54,400
and interrupting orbital verification

1144
00:48:02,700 --> 00:47:58,980
not a good idea words like impossible

1145
00:48:05,010 --> 00:48:02,710
inconceivable were bandied about so I

1146
00:48:10,040 --> 00:48:05,020
was asked well what is it that Hubble

1147
00:48:13,520 --> 00:48:10,050
and only Hubble can do and i responded

1148
00:48:16,830 --> 00:48:13,530
high resolution visible imaging

1149
00:48:20,390 --> 00:48:16,840
ultraviolent imaging only Hubble can do

1150
00:48:23,130 --> 00:48:20,400
that so we got approval for the time

1151
00:48:25,470 --> 00:48:23,140
obtaining it was really really difficult

1152
00:48:28,320 --> 00:48:25,480
but they did do it and kudos to

1153
00:48:31,050 --> 00:48:28,330
everybody involved in that now in August

1154
00:48:33,540 --> 00:48:31,060
we released a small snapshot showing the

1155
00:48:35,490 --> 00:48:33,550
impact site and if we could show that to

1156
00:48:37,620 --> 00:48:35,500
the people here and there you can see

1157
00:48:40,200 --> 00:48:37,630
the black clouds that were created

1158
00:48:43,740 --> 00:48:40,210
during the explosion when this object

1159
00:48:46,140 --> 00:48:43,750
hit jupiter the details in this image

1160
00:48:48,630 --> 00:48:46,150
far surpass anything that we have been

1161
00:48:52,350 --> 00:48:48,640
able to obtain from the ground we just

1162
00:48:54,660 --> 00:48:52,360
got our last set of images yesterday so

1163
00:48:56,490 --> 00:48:54,670

I can't I haven't even seen them yet so

1164
00:48:57,930 --> 00:48:56,500
I can't show them to you yet but I do

1165
00:49:01,170 --> 00:48:57,940
have something I'd like to share with

1166
00:49:05,210 --> 00:49:01,180
you and that is Hubble's view of the

1167
00:49:07,259 --> 00:49:05,220
full disc of Jupiter in glorious color

1168
00:49:10,229 --> 00:49:07,269
this image

1169
00:49:13,469 --> 00:49:10,239
is our highest resolution image of

1170
00:49:15,659 --> 00:49:13,479
Jupiter since 2007 when the New Horizons

1171
00:49:18,359 --> 00:49:15,669
mission flew over the cloud tops of

1172
00:49:21,179 --> 00:49:18,369
Jupiter and you can see the impact site

1173
00:49:23,789 --> 00:49:21,189
down in the bottom there but you can

1174
00:49:27,509 --> 00:49:23,799
also see fantastic structure in detail

1175
00:49:29,489 --> 00:49:27,519
across the rest of the disk this was an

1176
00:49:31,829 --> 00:49:29,499
extremely challenging observation to

1177
00:49:34,589 --> 00:49:31,839
make it was tuned for science not for

1178
00:49:35,939 --> 00:49:34,599
public release and so Michael Wong at

1179
00:49:38,279 --> 00:49:35,949
the Space Telescope Science Institute

1180
00:49:40,199 --> 00:49:38,289
how to do a tremendous amount of work to

1181
00:49:41,939 --> 00:49:40,209
be able to recombine our different

1182
00:49:45,419 --> 00:49:41,949
colored filters into this beautiful

1183
00:49:47,249 --> 00:49:45,429
image but it's fantastic now this

1184
00:49:49,709 --> 00:49:47,259
illustrates a superb aspect of the

1185
00:49:52,109 --> 00:49:49,719
revitalized Hubble and that is its wide

1186
00:49:53,399 --> 00:49:52,119
field imaging capability this is

1187
00:49:55,559 --> 00:49:53,409
something that all of us are really

1188
00:49:59,519 --> 00:49:55,569

going to be taking advantage of his the

1189
00:50:01,649 --> 00:49:59,529
ability to get very large pictures the

1190
00:50:03,829 --> 00:50:01,659
color composite also talks about the

1191
00:50:06,329 --> 00:50:03,839
different kinds of colors that we see

1192
00:50:08,639 --> 00:50:06,339
this is made with visible wavelengths

1193
00:50:10,380 --> 00:50:08,649
red green and blue but we also have some

1194
00:50:12,989 --> 00:50:10,390
fantastic ultraviolet and near infrared

1195
00:50:17,069 --> 00:50:12,999
data that we will be analyzing in great

1196
00:50:19,679 --> 00:50:17,079
detail more broadly speaking the true

1197
00:50:21,599 --> 00:50:19,689
power of Hubble lies just to the

1198
00:50:24,929 --> 00:50:21,609
creativity of the collective minds of

1199
00:50:26,789 --> 00:50:24,939
our community as this final image which

1200
00:50:30,289 --> 00:50:26,799
is a montage of the images that you've

1201
00:50:33,179 --> 00:50:30,299
seen before illustrates every field of

1202
00:50:35,909 --> 00:50:33,189
astrophysics whether it's our local

1203
00:50:39,029 --> 00:50:35,919
neighbourhood of planets nearby stars

1204
00:50:41,099 --> 00:50:39,039
and their attendant planets galaxies

1205
00:50:43,739 --> 00:50:41,109
clusters of galaxies out to the edge of

1206
00:50:47,809 --> 00:50:43,749
the universe every field has questions

1207
00:50:50,549 --> 00:50:47,819
that are awaiting the power of Hubble

1208
00:50:53,699 --> 00:50:50,559
the brief descriptions of the science

1209
00:50:55,949 --> 00:50:53,709
that you heard earlier they just barely

1210
00:50:57,269 --> 00:50:55,959
scratched the surface of the science

1211
00:50:59,549 --> 00:50:57,279
we're going to do you're only getting

1212
00:51:00,959 --> 00:50:59,559
the tiniest taste of what the

1213
00:51:06,109 --> 00:51:00,969

astronomers are planning to do with

1214
00:51:11,849 --> 00:51:09,239
we in the community are already starting

1215
00:51:13,919 --> 00:51:11,859
to get our data and we're giddy with the

1216
00:51:15,659 --> 00:51:13,929
quality of the data that we have with

1217
00:51:17,879 --> 00:51:15,669
this new telescope we are especially

1218
00:51:20,640 --> 00:51:17,889
excited to have the spectroscopic

1219
00:51:22,950 --> 00:51:20,650
capability restored to Hubble

1220
00:51:26,210 --> 00:51:22,960
spectrographs and I can say that in the

1221
00:51:28,799 --> 00:51:26,220
plural now they permit us to work on a

1222
00:51:31,710 --> 00:51:28,809
mind-boggling array of scientific

1223
00:51:34,440 --> 00:51:31,720
questions over a huge range of sizes as

1224
00:51:37,109 --> 00:51:34,450
you heard we're talking about atoms and

1225
00:51:39,180 --> 00:51:37,119
molecules and how they combine and

1226
00:51:41,549 --> 00:51:39,190
interact with their environment but

1227
00:51:46,470 --> 00:51:41,559
we're doing that on scales that are

1228
00:51:48,630 --> 00:51:46,480
there I say astronomical so again we are

1229
00:51:50,460 --> 00:51:48,640
entering a new era of astronomy Hubble's

1230
00:51:53,160 --> 00:51:50,470
new beginning is just setting the stage

1231
00:51:55,049 --> 00:51:53,170
for what's going to be coming including

1232
00:51:58,140 --> 00:51:55,059
the next great space observatory the

1233
00:52:00,839 --> 00:51:58,150
James Webb Space Telescope with this new

1234
00:52:03,569 --> 00:52:00,849
beginning for Hubble we can now see more

1235
00:52:05,849 --> 00:52:03,579
clearly and understand more deeply the

1236
00:52:09,329 --> 00:52:05,859
processes that create and shape and

1237
00:52:13,200 --> 00:52:09,339
drive change within our universe Hubble

1238
00:52:15,779 --> 00:52:13,210

is back in action together NASA and

1239
00:52:18,829 --> 00:52:15,789
Hubble are opening new vistas on the

1240
00:52:26,410 --> 00:52:18,839
universe and I'll turn it back to you JD

1241
00:52:31,250 --> 00:52:28,460
much time now for our question and

1242
00:52:33,470 --> 00:52:31,260
answer session and before we begin just

1243
00:52:35,570 --> 00:52:33,480
a few caveats if you would wait until we

1244
00:52:37,850 --> 00:52:35,580
get a microphone to you please identify

1245
00:52:40,190 --> 00:52:37,860
yourself and your media affiliation

1246
00:52:42,200 --> 00:52:40,200
before you begin and if you would tailor

1247
00:52:44,150 --> 00:52:42,210
your questions to a specific panelist if

1248
00:52:46,760 --> 00:52:44,160
you can to avoid any confusion in that

1249
00:52:55,190 --> 00:52:46,770
and with that let's let's start with

1250
00:52:58,820 --> 00:52:55,200
Seth from AP it's on p actually for Dave

1251
00:53:00,590 --> 00:52:58,830
to one question with the follow up these

1252
00:53:03,590 --> 00:53:00,600
all seem to be as you said all except

1253
00:53:06,470 --> 00:53:03,600
for one where in our galaxy how far what

1254
00:53:09,200 --> 00:53:06,480
is the deepest you've looked so far how

1255
00:53:11,510 --> 00:53:09,210
does that compare to how far you expect

1256
00:53:13,940 --> 00:53:11,520
to be able to look now and how far

1257
00:53:16,850 --> 00:53:13,950
you've been able to look the past yeah I

1258
00:53:20,180 --> 00:53:16,860
I can't give you a really quantitative

1259
00:53:21,980 --> 00:53:20,190
answer to that but I'll do my best we

1260
00:53:24,350 --> 00:53:21,990
have a program that is about to begin

1261
00:53:26,240 --> 00:53:24,360
which will it's another Ultra Deep Field

1262
00:53:28,070 --> 00:53:26,250
this time and infrared wavelengths that

1263
00:53:30,650 --> 00:53:28,080

will probe as deep as we're able to

1264
00:53:33,290 --> 00:53:30,660
probe not sure of the status of that but

1265
00:53:35,560 --> 00:53:33,300
it's it's imminent to its beginning but

1266
00:53:38,540 --> 00:53:35,570
what we all have noticed in these images

1267
00:53:40,730 --> 00:53:38,550
again is you take an image of a

1268
00:53:43,640 --> 00:53:40,740
Stephan's quintet or you take an image

1269
00:53:45,770 --> 00:53:43,650
of you know one of the other objects

1270
00:53:47,480 --> 00:53:45,780
that we looked at and and often the

1271
00:53:50,420 --> 00:53:47,490
background there's all this stuff

1272
00:53:52,850 --> 00:53:50,430
they're marvelous details including

1273
00:53:55,400 --> 00:53:52,860
going down to small unresolved red blobs

1274
00:53:57,830 --> 00:53:55,410
and we know those small and resolve red

1275
00:54:00,440 --> 00:53:57,840
blobs in some cases not in all cases are

1276
00:54:02,480 --> 00:54:00,450
distant objects now they're not nearly

1277
00:54:04,130 --> 00:54:02,490
as distant as we're going to be probing

1278
00:54:06,230 --> 00:54:04,140
with the ultra-deep feels because these

1279
00:54:07,700 --> 00:54:06,240
are relatively short exposure times but

1280
00:54:09,620 --> 00:54:07,710
you can already see remarkable

1281
00:54:11,240 --> 00:54:09,630
differences between what we're seeing

1282
00:54:13,730 --> 00:54:11,250
now and what we saw the prior

1283
00:54:16,130 --> 00:54:13,740
instrumentation just in this ability to

1284
00:54:17,510 --> 00:54:16,140
see oh look what's in the background

1285
00:54:20,990 --> 00:54:17,520
like goodness I didn't realize that was

1286
00:54:22,760 --> 00:54:21,000
there so it's not a quantitative answer

1287
00:54:24,320 --> 00:54:22,770
but it says it says that that we're

1288
00:54:27,230 --> 00:54:24,330

really sensitive maybe even more

1289
00:54:29,210 --> 00:54:27,240
sensitive and we thought we were okay

1290
00:54:31,520 --> 00:54:29,220
thank you had to follow up maybe for

1291
00:54:35,380 --> 00:54:31,530
Heidi given the bigger picture

1292
00:54:37,109 --> 00:54:35,390
especially the two beauty shots of the

1293
00:54:40,309 --> 00:54:37,119
medaka Rena

1294
00:54:44,009 --> 00:54:40,319
and the butterfly you see these sort of

1295
00:54:47,880 --> 00:54:44,019
glows this backlit glow that you almost

1296
00:54:51,210 --> 00:54:47,890
seems heavenly in a way uh one can you

1297
00:54:53,819 --> 00:54:51,220
just for someone who keeps looking at

1298
00:54:56,249 --> 00:54:53,829
you know these type of images does it

1299
00:54:58,499 --> 00:54:56,259
lose the magic in the luster for you or

1300
00:55:01,380 --> 00:54:58,509
how beautiful is this to someone like

1301
00:55:03,779 --> 00:55:01,390
you see watches us all the time and just

1302
00:55:07,739 --> 00:55:03,789
the glow what is that because some

1303
00:55:11,489 --> 00:55:07,749
people might see a little bit of might

1304
00:55:15,710 --> 00:55:11,499
find some spirituality that I don't

1305
00:55:18,480 --> 00:55:15,720
think we ever lose the awe and Wonder I

1306
00:55:21,509 --> 00:55:18,490
mean I've looked at hundreds of pictures

1307
00:55:24,450 --> 00:55:21,519
of Jupiter but when I saw the first

1308
00:55:29,849 --> 00:55:24,460
images of Jupiter come back from this

1309
00:55:34,259 --> 00:55:29,859
impact site just a month ago all we

1310
00:55:36,180 --> 00:55:34,269
could say was wow you don't lose the

1311
00:55:38,700 --> 00:55:36,190
wonder you don't lose the glory the

1312
00:55:40,680 --> 00:55:38,710
beauty is there to be appreciated in

1313
00:55:44,249 --> 00:55:40,690

each new image that comes down with

1314
00:55:47,729 --> 00:55:44,259
Hubble and as we use Hubble over the

1315
00:55:49,859 --> 00:55:47,739
next many years looking at things that

1316
00:55:52,140 --> 00:55:49,869
we haven't seen before with our new

1317
00:55:54,809 --> 00:55:52,150
cameras probing deeper than we've seen

1318
00:55:58,140 --> 00:55:54,819
before there will be even more wonders

1319
00:56:00,960 --> 00:55:58,150
for us to look at so I think it's

1320
00:56:03,960 --> 00:56:00,970
fantastic we're not losing you don't get

1321
00:56:08,489 --> 00:56:03,970
jaded you just keep being enthralled

1322
00:56:10,950 --> 00:56:08,499
with every new image thanks Heidi real

1323
00:56:12,989 --> 00:56:10,960
quick caveat to the briefing my

1324
00:56:14,190 --> 00:56:12,999
apologies to the sts-125 crew we are

1325
00:56:17,700 --> 00:56:14,200
going to go a little bit long but we

1326
00:56:19,289 --> 00:56:17,710
will get you on here also we'll probably

1327
00:56:20,880 --> 00:56:19,299
have to limit follow-on because of the

1328
00:56:22,019 --> 00:56:20,890
number of media that we have wanting to

1329
00:56:23,430 --> 00:56:22,029
ask questions and finally to the

1330
00:56:25,769 --> 00:56:23,440
panelists if you would try to keep your

1331
00:56:27,029 --> 00:56:25,779
brief answers as brief as possible you

1332
00:56:28,829 --> 00:56:27,039
can't answer the question but try to

1333
00:56:31,279 --> 00:56:28,839
hold it down if you can and without any

1334
00:56:34,229 --> 00:56:31,289
other questions here in the the audience

1335
00:56:36,930 --> 00:56:34,239
alright Joe here in the front from the

1336
00:56:38,690 --> 00:56:36,940
Washington Post yeah quick question Joel

1337
00:56:41,970 --> 00:56:38,700
Achenbach with the Washington Post ed

1338
00:56:44,160 --> 00:56:41,980

with this mission being so tremendously

1339
00:56:47,660 --> 00:56:44,170
successful this for this servicing

1340
00:56:50,760 --> 00:56:47,670
mission is there any new impetus for

1341
00:56:52,720 --> 00:56:50,770
serviceable telescopes

1342
00:56:55,870 --> 00:56:52,730
particularly with the Augustine

1343
00:56:58,270 --> 00:56:55,880
Commission looking at some new ideas for

1344
00:57:00,130 --> 00:56:58,280
the strategy ahead involving this deep

1345
00:57:03,670 --> 00:57:00,140
space capability where you might be able

1346
00:57:05,890 --> 00:57:03,680
to go out to a million miles out right

1347
00:57:08,200 --> 00:57:05,900
well all we've got so far is executive

1348
00:57:10,540 --> 00:57:08,210
summary for the Augustine Commission so

1349
00:57:13,180 --> 00:57:10,550
it'd be premature to comment we're

1350
00:57:14,559 --> 00:57:13,190
waiting until we get the full report and

1351
00:57:16,690 --> 00:57:14,569
then we'll be working with the OMB and

1352
00:57:20,710 --> 00:57:16,700
and the Office of Science and Technology

1353
00:57:23,260 --> 00:57:20,720
Policy of how we would respond to it but

1354
00:57:25,059 --> 00:57:23,270
ultimately I'm not speaking specifically

1355
00:57:29,079 --> 00:57:25,069
about the Augustine Commission but

1356
00:57:31,960 --> 00:57:29,089
ultimately if we talking 20 30 40 50

1357
00:57:33,910 --> 00:57:31,970
years from now I mean in in this century

1358
00:57:36,190 --> 00:57:33,920
we're going to have the capability of

1359
00:57:38,710 --> 00:57:36,200
finding a planet that we can say has

1360
00:57:40,930 --> 00:57:38,720
life on it there's no question we have

1361
00:57:43,780 --> 00:57:40,940
the technology to do that trouble is

1362
00:57:48,309 --> 00:57:43,790
that takes very large telescopes perhaps

1363
00:57:50,200 --> 00:57:48,319

even interferometers and I have a my gut

1364
00:57:52,089 --> 00:57:50,210
level my own personal opinion not

1365
00:57:53,650 --> 00:57:52,099
speaking for NASA now that the way we're

1366
00:57:55,900 --> 00:57:53,660
going to build those new telescope is

1367
00:57:57,730 --> 00:57:55,910
it's probably assemble them in deep

1368
00:58:00,220 --> 00:57:57,740
space because you want to be a far way

1369
00:58:02,589 --> 00:58:00,230
away from the earth so you know there is

1370
00:58:04,690 --> 00:58:02,599
a future for construction you know of

1371
00:58:07,390 --> 00:58:04,700
large things in space but it's long way

1372
00:58:08,859 --> 00:58:07,400
down the road and what to see how you

1373
00:58:11,440 --> 00:58:08,869
know the Augustine Commission comes out

1374
00:58:15,130 --> 00:58:11,450
and whether that's part of a part of the

1375
00:58:16,780 --> 00:58:15,140
near term or far for future thanks dad

1376
00:58:22,290 --> 00:58:16,790
and now we're going to our field centers

1377
00:58:28,480 --> 00:58:24,690
hi Robert promo with collectspace.com

1378
00:58:31,390 --> 00:58:28,490
with a question I think for David you

1379
00:58:33,400 --> 00:58:31,400
you mentioned an ultra deep field coming

1380
00:58:36,670 --> 00:58:33,410
up but can you give a preview as to what

1381
00:58:38,559 --> 00:58:36,680
other images might next becoming is I

1382
00:58:41,079 --> 00:58:38,569
guess Hubble's supposed to support the

1383
00:58:43,870 --> 00:58:41,089
El cross impact what other targets are

1384
00:58:46,210 --> 00:58:43,880
on the horizon yeah we have just begun

1385
00:58:48,370 --> 00:58:46,220
the process of doing science with our

1386
00:58:50,440 --> 00:58:48,380
with our newly reconditioned instruments

1387
00:58:51,970 --> 00:58:50,450
and we're in what's called cycle 17

1388
00:58:53,950 --> 00:58:51,980

which is about the which is

1389
00:58:56,099 --> 00:58:53,960
approximately a year long and it's a

1390
00:58:58,000 --> 00:58:56,109
pre-selected peer-reviewed

1391
00:59:00,280 --> 00:58:58,010
scientifically excellent observing

1392
00:59:03,490 --> 00:59:00,290
programme so what I can tell you a

1393
00:59:04,240 --> 00:59:03,500
little bit about there is that for well

1394
00:59:07,000 --> 00:59:04,250
for one thing

1395
00:59:08,710 --> 00:59:07,010
we're all interested in Pluto and is it

1396
00:59:11,890 --> 00:59:08,720
a planet or not and we know that there's

1397
00:59:14,020 --> 00:59:11,900
a whole population of Pluto Pluto like

1398
00:59:16,180 --> 00:59:14,030
objects out in the Kuiper belt beyond

1399
00:59:17,950 --> 00:59:16,190
the orbit of Neptune and Pluto so we're

1400
00:59:19,990 --> 00:59:17,960
going to be doing a large survey to try

1401
00:59:23,080 --> 00:59:20,000
to understand more about our own outer

1402
00:59:25,120 --> 00:59:23,090
solar system we certainly are going to

1403
00:59:26,830 --> 00:59:25,130
be using the space telescope imaging

1404
00:59:29,110 --> 00:59:26,840
spectrograph and the cosmic origins

1405
00:59:32,110 --> 00:59:29,120
spectrograph and the Nick moss when it

1406
00:59:33,670 --> 00:59:32,120
comes back online to continue looking at

1407
00:59:36,340 --> 00:59:33,680
the atmospheres of planets around other

1408
00:59:38,770 --> 00:59:36,350
stars we had shown some success and

1409
00:59:40,840 --> 00:59:38,780
coming up with information about the

1410
00:59:43,720 --> 00:59:40,850
chemical composition of exoplanets and

1411
00:59:47,110 --> 00:59:43,730
we're certainly now well posture to push

1412
00:59:48,700 --> 00:59:47,120
that forward there's almost no area of a

1413
00:59:50,350 --> 00:59:48,710

strike I mean I can't cite the cycle

1414
00:59:52,540 --> 00:59:50,360
seven observing programme off the top of

1415
00:59:53,800 --> 00:59:52,550
my head that is online by the way at the

1416
00:59:55,870 --> 00:59:53,810
Space Telescope Science Institute

1417
00:59:58,210 --> 00:59:55,880
website if you'd like to see the whole

1418
01:00:01,450 --> 00:59:58,220
rundown on them all I can tell you is

1419
01:00:03,940 --> 01:00:01,460
that there are particular themes for

1420
01:00:06,520 --> 01:00:03,950
which the door was opened by prior

1421
01:00:08,740 --> 01:00:06,530
Hubble observations and now we're well

1422
01:00:10,270 --> 01:00:08,750
posture to walk through the door and the

1423
01:00:14,290 --> 01:00:10,280
exoplanet atmospheres is an excellent

1424
01:00:15,940 --> 01:00:14,300
example of that thanks David now we're

1425
01:00:20,320 --> 01:00:15,950
going to go down to Florida with the

1426
01:00:22,150 --> 01:00:20,330
reporter of the Kennedy Space Center hi

1427
01:00:23,680 --> 01:00:22,160
everyone is still hardwood with CBS News

1428
01:00:25,630 --> 01:00:23,690
and I'll ask this question to any of you

1429
01:00:26,890 --> 01:00:25,640
and it's the question that you get asked

1430
01:00:28,360 --> 01:00:26,900
every time there is a Hubble news

1431
01:00:30,640 --> 01:00:28,370
conference but i'm going to ask it one

1432
01:00:33,880 --> 01:00:30,650
more time which is with the new

1433
01:00:35,560 --> 01:00:33,890
capabilities that that HST now has how

1434
01:00:38,620 --> 01:00:35,570
does Hubble fit into the firmament of

1435
01:00:40,540 --> 01:00:38,630
major telescopes on the planet and

1436
01:00:42,400 --> 01:00:40,550
elsewhere in other words the big monster

1437
01:00:44,410 --> 01:00:42,410
scopes that are coming online down you

1438
01:00:46,000 --> 01:00:44,420

know downstream where does hub will fit

1439
01:00:49,860 --> 01:00:46,010
in with all of those guys with the

1440
01:00:56,110 --> 01:00:53,500
physics rules now pass it to Heidi but

1441
01:00:58,060 --> 01:00:56,120
physics rules we have an atmosphere to

1442
01:00:59,980 --> 01:00:58,070
look through ok there are ways to

1443
01:01:02,440 --> 01:00:59,990
mitigate the atmosphere call call

1444
01:01:04,240 --> 01:01:02,450
adaptive optics where you have rubbery

1445
01:01:06,550 --> 01:01:04,250
mirrors which try to try to correct for

1446
01:01:07,990 --> 01:01:06,560
the atmosphere trouble is you can do

1447
01:01:10,060 --> 01:01:08,000
that you can do it very effectively

1448
01:01:12,700 --> 01:01:10,070
these large telescopes will have better

1449
01:01:16,810 --> 01:01:12,710
resolution than Hubble but over very

1450
01:01:17,980 --> 01:01:16,820
very tiny fields of you I cannot unless

1451
01:01:20,200 --> 01:01:17,990
somebody can correct me here

1452
01:01:22,570 --> 01:01:20,210
cannot conceive of taking a picture of

1453
01:01:23,980 --> 01:01:22,580
the Eagle Nebula with adaptive optics

1454
01:01:27,220 --> 01:01:23,990
and getting the resolution that Hubble

1455
01:01:29,200 --> 01:01:27,230
has ultimately as the telescope's get to

1456
01:01:31,270 --> 01:01:29,210
be 10 20 30 meters they will have more

1457
01:01:33,910 --> 01:01:31,280
light gathering power and Hubble they'll

1458
01:01:35,920 --> 01:01:33,920
be able to go deeper but then we've got

1459
01:01:38,080 --> 01:01:35,930
something up our sleeve called jdub Jim

1460
01:01:40,780 --> 01:01:38,090
Webb Space Telescope which will start

1461
01:01:42,790 --> 01:01:40,790
the race all over again the other thing

1462
01:01:45,850 --> 01:01:42,800
that Hubble can do that can never ever

1463
01:01:48,850 --> 01:01:45,860

be done from the ground is imaging in

1464
01:01:51,460 --> 01:01:48,860
the ultraviolet and imaging in some of

1465
01:01:53,710 --> 01:01:51,470
the infrared near-infrared wavelengths

1466
01:01:56,650 --> 01:01:53,720
of light because our Earth's atmosphere

1467
01:01:58,660 --> 01:01:56,660
absorbs the photons before they get to

1468
01:02:01,000 --> 01:01:58,670
the surface of the earth so you could

1469
01:02:02,500 --> 01:02:01,010
make a football-sized field telescope

1470
01:02:05,320 --> 01:02:02,510
and you'll never collect the photons

1471
01:02:07,600 --> 01:02:05,330
because they aren't there so Hubble is

1472
01:02:10,630 --> 01:02:07,610
absolutely unique and we must have a

1473
01:02:12,160 --> 01:02:10,640
telescope in space to complement the

1474
01:02:14,290 --> 01:02:12,170
very large telescopes on the ground

1475
01:02:16,870 --> 01:02:14,300
Hubble is absolutely unique at those

1476
01:02:20,280 --> 01:02:16,880
wavelengths nothing else can do it we're

1477
01:02:26,349 --> 01:02:23,760
hi it's Peter King at CBS News Radio and

1478
01:02:27,820 --> 01:02:26,359
uh I guess I'll ask this of Dave

1479
01:02:30,640 --> 01:02:27,830
leckrone and this is kind of a big

1480
01:02:32,859 --> 01:02:30,650
picture projecting ahead by maybe a

1481
01:02:35,230 --> 01:02:32,869
hundred years when we have some of those

1482
01:02:38,200 --> 01:02:35,240
bigger better telescopes maybe that are

1483
01:02:40,780 --> 01:02:38,210
built millions of miles out in space how

1484
01:02:44,680 --> 01:02:40,790
will history look back on what uh what

1485
01:02:48,490 --> 01:02:44,690
Hubble has done in its first 20 in 20-25

1486
01:02:52,540 --> 01:02:48,500
years or so well of course we need to be

1487
01:02:55,609 --> 01:02:52,550
humble and we need to

1488
01:02:57,530 --> 01:02:55,619

but in all humility I truly believe that

1489
01:03:00,260 --> 01:02:57,540
that Hubble has fundamentally changed

1490
01:03:02,780 --> 01:03:00,270
the course of modern astronomy and

1491
01:03:05,589 --> 01:03:02,790
astrophysics and and is taking it in new

1492
01:03:08,750 --> 01:03:05,599
directions and new discoveries will

1493
01:03:14,440 --> 01:03:08,760
reorient the path of science in other

1494
01:03:19,970 --> 01:03:17,089
what I don't see I'm struggling for a

1495
01:03:22,099 --> 01:03:19,980
word we basically have shoved aside the

1496
01:03:24,470 --> 01:03:22,109
old textbooks and the old concepts of

1497
01:03:26,510 --> 01:03:24,480
the universe we live in that were based

1498
01:03:28,099 --> 01:03:26,520
entirely on this distorted view that we

1499
01:03:30,500 --> 01:03:28,109
had through the Earth's atmosphere and

1500
01:03:33,290 --> 01:03:30,510
we have laid a foundation of clear

1501
01:03:36,710 --> 01:03:33,300
vision that that is the starting point

1502
01:03:38,420 --> 01:03:36,720
from which all future UV optical and

1503
01:03:41,570 --> 01:03:38,430
near-infrared astronomy will will

1504
01:03:44,420 --> 01:03:41,580
proceed and 100 years from now people

1505
01:03:47,630 --> 01:03:44,430
may have forgotten you know what we did

1506
01:03:50,599 --> 01:03:47,640
here in this place and in this time but

1507
01:03:54,670 --> 01:03:50,609
that doesn't change the fact that we did

1508
01:03:58,040 --> 01:03:54,680
set the course of research on its path

1509
01:04:00,020 --> 01:03:58,050
all right any other fellow any other

1510
01:04:03,050 --> 01:04:00,030
follow-up questions here we'd like to

1511
01:04:04,640 --> 01:04:03,060
ask all right having known at the field

1512
01:04:06,859 --> 01:04:04,650
centers as well as our telephone bridge

1513
01:04:08,720 --> 01:04:06,869

will now go to EDD Wyler for closing

1514
01:04:11,930 --> 01:04:08,730
comments okay I'll keep this short

1515
01:04:13,670 --> 01:04:11,940
because we're over time but just wanted

1516
01:04:16,849 --> 01:04:13,680
to reminisce a little bit we've come a

1517
01:04:18,170 --> 01:04:16,859
long way since 1990 I woke up this

1518
01:04:20,240 --> 01:04:18,180
morning I felt like I was in the

1519
01:04:22,130 --> 01:04:20,250
groundhog day movie because we've done

1520
01:04:25,640 --> 01:04:22,140
this six times before that is press

1521
01:04:28,040 --> 01:04:25,650
conferences after small tight periods

1522
01:04:31,220 --> 01:04:28,050
the first one wasn't so pleasant was jun

1523
01:04:33,349 --> 01:04:31,230
27th 28th 1990 and we had announced

1524
01:04:36,109 --> 01:04:33,359
spherical aberration and an optical

1525
01:04:37,670 --> 01:04:36,119
problem many people inside the beltway

1526
01:04:40,070 --> 01:04:37,680
and outside the beltway said we should

1527
01:04:42,140 --> 01:04:40,080
just cancel mobile was a waste of money

1528
01:04:44,780 --> 01:04:42,150
he never would have achieved what we

1529
01:04:46,099 --> 01:04:44,790
said anyway we said we had a way to fix

1530
01:04:47,870 --> 01:04:46,109
it something called the wide field

1531
01:04:50,120 --> 01:04:47,880
planetary camera 2 with corrective

1532
01:04:52,849 --> 01:04:50,130
lenses if the senator likes to talk

1533
01:04:55,160 --> 01:04:52,859
about something also called co-star

1534
01:04:57,500 --> 01:04:55,170
nobody believed well very few people

1535
01:05:02,270 --> 01:04:57,510
believed that it could be done but the

1536
01:05:04,880 --> 01:05:02,280
Hubble team of Center people astronauts

1537
01:05:08,900 --> 01:05:04,890
etc prove them wrong in December

1538
01:05:12,400 --> 01:05:08,910

1993 and our Redemption day was that

1539
01:05:15,200 --> 01:05:12,410
date January thirteenth 1994 when Hubble

1540
01:05:17,630 --> 01:05:15,210
began its new life since then we've had

1541
01:05:19,310 --> 01:05:17,640
four other servicing missions basically

1542
01:05:22,790 --> 01:05:19,320
Hubble has gotten better and better and

1543
01:05:25,160 --> 01:05:22,800
better what Dave and I 30 years ago or

1544
01:05:27,020 --> 01:05:25,170
20 years ago said that for those first

1545
01:05:29,240 --> 01:05:27,030
press conferences the promises you made

1546
01:05:31,870 --> 01:05:29,250
we made those look conservative compared

1547
01:05:34,940 --> 01:05:31,880
to what we have actually accomplished

1548
01:05:38,150 --> 01:05:34,950
and it took thousands of people to make

1549
01:05:41,000 --> 01:05:38,160
that happen and especially I have to

1550
01:05:42,980 --> 01:05:41,010
give special notice to 32 people who

1551
01:05:44,900 --> 01:05:42,990
kept us from being orbital space junk

1552
01:05:46,910 --> 01:05:44,910
which it would have turned into and

1553
01:05:48,560 --> 01:05:46,920
those are the 32 astronauts that have

1554
01:05:50,720 --> 01:05:48,570
flown up to alleble and risked their

1555
01:06:02,930 --> 01:05:50,730
lives to keep a scientist very very

1556
01:06:05,330 --> 01:06:02,940
happy and just a few more thoughts I'd

1557
01:06:07,040 --> 01:06:05,340
be remiss if I didn't recognize another

1558
01:06:09,800 --> 01:06:07,050
colleague that's been instrumental along

1559
01:06:12,110 --> 01:06:09,810
the way my friend David Crone although

1560
01:06:16,220 --> 01:06:12,120
we haven't always seen eye to eye who

1561
01:06:18,100 --> 01:06:16,230
does David spent 30 years like I have

1562
01:06:21,200 --> 01:06:18,110
actually more than 30 years both of us

1563
01:06:22,970 --> 01:06:21,210

working for Hubble he like I gave up a

1564
01:06:24,350 --> 01:06:22,980
research career early in our lives and

1565
01:06:26,270 --> 01:06:24,360
decided would rather work for the

1566
01:06:29,420 --> 01:06:26,280
government for the exorbitant salaries

1567
01:06:32,870 --> 01:06:29,430
obviously but really to to really enable

1568
01:06:34,160 --> 01:06:32,880
other people to do research so that's

1569
01:06:35,570 --> 01:06:34,170
that was something we gave up but I

1570
01:06:37,640 --> 01:06:35,580
don't think would ever change the way we

1571
01:06:40,640 --> 01:06:37,650
progressed and dave was going to retire

1572
01:06:42,350 --> 01:06:40,650
in a couple weeks and I'd like to thank

1573
01:06:44,810 --> 01:06:42,360
him for the on behalf of the entire

1574
01:06:57,500 --> 01:06:44,820
science community for your service to

1575
01:07:05,310 --> 01:07:02,070
and one last thought I wanted or two

1576
01:07:07,710 --> 01:07:05,320
last thoughts Hubble has inspired not

1577
01:07:10,170 --> 01:07:07,720
just astronomers but people of all ages

1578
01:07:13,200 --> 01:07:10,180
from young school kids to senior

1579
01:07:15,870 --> 01:07:13,210
citizens it has become a scientific icon

1580
01:07:18,359 --> 01:07:15,880
it's almost become a cultural icon you

1581
01:07:20,280 --> 01:07:18,369
see it on the walls in movies you see it

1582
01:07:23,940 --> 01:07:20,290
if you watch Star Trek Voyager was

1583
01:07:25,859 --> 01:07:23,950
splattered all over the main deck why is

1584
01:07:30,630 --> 01:07:25,869
this wise it's become such a cultural

1585
01:07:32,760 --> 01:07:30,640
icon this is one person's theory most of

1586
01:07:35,099 --> 01:07:32,770
us humans certainly many of us humans

1587
01:07:38,070 --> 01:07:35,109
will never travel to some of the exotic

1588
01:07:42,390 --> 01:07:38,080

places physically that we see in Hubble

1589
01:07:46,140 --> 01:07:42,400
what Hubble has done it's enabled our

1590
01:07:48,240 --> 01:07:46,150
hearts our minds our spirits to travel

1591
01:07:50,490 --> 01:07:48,250
throughout the solar system even

1592
01:07:53,550 --> 01:07:50,500
billions of light-years to the very

1593
01:07:55,650 --> 01:07:53,560
beginning of time almost and I think its

1594
01:07:58,470 --> 01:07:55,660
ability to inspire at least some of our

1595
01:08:00,540 --> 01:07:58,480
school kids to consider careers in

1596
01:08:02,970 --> 01:08:00,550
engineering and science and math that

1597
01:08:06,420 --> 01:08:02,980
will be its most important legacy not

1598
01:08:09,060 --> 01:08:06,430
just keeping us astronomers happy and

1599
01:08:11,099 --> 01:08:09,070
what's next in 2014 NASA will launch the

1600
01:08:12,720 --> 01:08:11,109
James Webb Space Telescope that will

1601
01:08:15,240 --> 01:08:12,730
continue Hubble's scientific tradition

1602
01:08:17,039 --> 01:08:15,250
for the foreseeable future hopefully

1603
01:08:20,459 --> 01:08:17,049
both of them operate for many years

1604
01:08:22,559 --> 01:08:20,469
beyond 2014 the bottom line though is

1605
01:08:25,349 --> 01:08:22,569
NASA NASA will remain at the forefront

1606
01:08:27,630 --> 01:08:25,359
of the scientific exploration of the

1607
01:08:29,190 --> 01:08:27,640
universe and what that will close