1
00:00:00,000 --> 00:00:00,734
[Music Plays]

2
00:00:00,734 --> 00:00:24,124
ERIN:
Hi, Facebook.

3
00:00:24,124 --> 00:00:26,226
We're live from NASA
Goddard's Space Flight Center.

4
00:00:26,226 --> 00:00:31,531
I'm Erin Kisliuk and you
are live in 360 at the Hubble

5
00:00:31,531 --> 00:00:34,835
Space Telescope
Operations Control Center.

6
00:00:34,835 --> 00:00:35,669
Take a look around.

7
00:00:35,669 --> 00:00:38,906
This place is the heart, soul,
and the brains of the Hubble

8
00:00:38,906 --> 00:00:43,243
Space Telescope who
launched 28 years ago today.

9
00:00:43,243 --> 00:00:47,080
Speaking of brains, we've
got a couple of pretty smart

10
00:00:47,080 --> 00:00:50,250
folks here to answer your
questions so send them all in to

11
00:00:50,250 --> 00:00:53,854

the comments section below so we
can answer them during the show

12
00:00:53,854 --> 00:00:55,856
and even a few after it's ended.

13
00:00:55,856 --> 00:00:59,927
So without further ado, we've
got Deputy Project Manager

14
00:00:59,927 --> 00:01:00,527
Jim Jeletic.

15
00:01:00,527 --> 00:01:01,595
JIM: Hi, Erin.

16
00:01:01,595 --> 00:01:02,529
ERIN: Hey, Jim.

17
00:01:02,529 --> 00:01:03,697
Thanks so much for being here.

18
00:01:03,697 --> 00:01:04,965
JIM: Thanks for having me.

19
00:01:04,965 --> 00:01:08,702
ERIN: So, Hubble is
such an iconic, iconic mission

20
00:01:08,702 --> 00:01:10,304
but it's not so young anymore.

21
00:01:10,304 --> 00:01:11,004
How's Hubble doing?

22
00:01:11,004 --> 00:01:13,774
(1:09) JIM: Well, science-wise
it is at the peak of its

23
00:01:13,774 --> 00:01:15,042
scientific capability.

24
00:01:15,042 --> 00:01:15,909
It's been doing great.

25
00:01:15,909 --> 00:01:19,279
In fact, this year we had
more papers published on its

26
00:01:19,279 --> 00:01:21,882
discoveries than ever
in its 28 year history.

27
00:01:21,882 --> 00:01:24,184
And as far as the
spacecraft is concerned, you

28
00:01:24,184 --> 00:01:26,553
know, even with all those parts
that are on it that have been

29
00:01:26,553 --> 00:01:30,590
flying in the harsh environment
of space for 28 years, we still

30
00:01:30,590 --> 00:01:32,659
have redundancy in all
of its critical systems.

31
00:01:32,659 --> 00:01:35,128
We're hopeful that we
can continue to make these

32
00:01:35,128 --> 00:01:38,298
groundbreaking observations
well into the next decade.

33
00:01:38,298 --> 00:01:39,800

ERIN: Into
the next decade?

34
00:01:39,800 --> 00:01:44,004
So, when Hubble was launched it
had a life expectancy of about

35
00:01:44,004 --> 00:01:45,339
15 years.

36
00:01:45,339 --> 00:01:47,074
How have we
managed to double that?

37
00:01:47,074 --> 00:01:51,044
JIM: Well, you know we
had 5 servicing missions that we

38
00:01:51,044 --> 00:01:53,680
went went up on a space
shuttle with astronauts and they

39
00:01:53,680 --> 00:01:57,651
repaired, replaced, and
upgraded its hardware over time.

40
00:01:57,651 --> 00:02:00,220
And it's kinda like your cell
phone you know when you get a

41
00:02:00,220 --> 00:02:02,956
new cell phone you get a
better camera on it a higher

42
00:02:02,956 --> 00:02:05,525
resolution, you can
take even better pictures.

43
00:02:05,525 --> 00:02:07,461
Well, we did that

with the instruments on Hubble.

44
00:02:07,461 --> 00:02:11,331
Because of that it's at its
peak of its capability and we're

45
00:02:11,331 --> 00:02:13,834
hopeful that we can continually
change our fundamental

46
00:02:13,834 --> 00:02:15,836
understanding of the universe
for years to come with it.

47
00:02:15,836 --> 00:02:17,304
ERIN: That sounds great.

48
00:02:17,304 --> 00:02:19,606
I just want to remind anyone
just tuning in that we are at

49
00:02:19,606 --> 00:02:22,175
NASA Goddard's Space
Flight Center in Hubble Space

50
00:02:22,175 --> 00:02:24,011
Telescope's
Operations Control Center.

51
00:02:24,011 --> 00:02:26,980
We're in 360 so take a look
around while I introduce our

52
00:02:26,980 --> 00:02:29,850
next guest we have Senior
Project Scientist

53
00:02:29,850 --> 00:02:31,284
Jennifer Wiseman joining us
today.

54
00:02:31,284 --> 00:02:31,952
Hi!

55
00:02:31,952 --> 00:02:32,619
JENNIFER: Hi, Erin.

56
00:02:32,619 --> 00:02:34,421
ERIN: Thank you so
much for being here.

57
00:02:34,421 --> 00:02:35,155
JENNIFER: My pleasure.

58
00:02:35,155 --> 00:02:39,259
ERIN: You've been on this
mission for about 11 years.

59
00:02:39,259 --> 00:02:42,462
Does Hubble still do anything or
show you anything that surprises

60
00:02:42,462 --> 00:02:43,130
you?

61
00:02:43,130 --> 00:02:46,066
JENNIFER: Oh my goodness,
every year Hubble

62
00:02:46,066 --> 00:02:46,733
is surprising us.

63
00:02:46,733 --> 00:02:49,669
We're looking at things with
Hubble now that we didn't even

64
00:02:49,669 --> 00:02:52,139
imagine that we would be
observing when it was launched

65
00:02:52,139 --> 00:02:53,407
back in 1990.

66
00:02:53,407 --> 00:02:56,343
For example, we are
studying the atmospheres of

67
00:02:56,343 --> 00:03:01,581
planets outside our solar system
and we recently observed light

68
00:03:01,581 --> 00:03:04,718
coming from a
merger of neutron stars.

69
00:03:04,718 --> 00:03:08,522
This event also created
gravitational waves and these

70
00:03:08,522 --> 00:03:11,358
are the kind of phenomena we
didn't even imagine decades

71
00:03:11,358 --> 00:03:11,525
ago.

72
00:03:11,558 --> 00:03:12,893
ERIN: That's amazing.

73
00:03:12,893 --> 00:03:16,763
And I hear Hubble sent us
something amazing for its own

74
00:03:16,763 --> 00:03:17,664
anniversary.

75
00:03:17,664 --> 00:03:19,332
Can we talk about

this image here?

76
00:03:19,332 --> 00:03:22,436
JENNIFER: We have
this great image of the

77
00:03:22,436 --> 00:03:23,103
Lagoon Nebula.

78
00:03:23,103 --> 00:03:28,642
So this is a region of gas and
dust that's being churned up by

79
00:03:28,642 --> 00:03:30,510
star formation.

80
00:03:30,510 --> 00:03:35,849
You can see a lot of features
like pillars and clumps of gas.

81
00:03:35,849 --> 00:03:39,419
It's lit up because one of the
stars that has recently formed

82
00:03:39,419 --> 00:03:40,954
is a monster star.

83
00:03:40,954 --> 00:03:43,590
It's about 200 thousand
times brighter than our sun.

84
00:03:43,590 --> 00:03:48,061
And it's ionizing the gas, it's
creating these structures, its

85
00:03:48,061 --> 00:03:52,566
winds and radiation are carving
out these various pillars and

86

00:03:52,566 --> 00:03:56,069
globules and so we like to think
of this as kind of a

87
00:03:56,069 --> 00:03:56,736
stellar nursery.

88
00:03:56,736 --> 00:03:58,305
ERIN: That's amazing.

89
00:03:58,305 --> 00:04:01,775
So are these two different
like parts of the nebula?

90
00:04:01,775 --> 00:04:02,909
Why do they look so different?

91
00:04:02,909 --> 00:04:05,278
JENNIFER: So you see
two images here, but they are

92
00:04:05,278 --> 00:04:06,980
actually the same place.

93
00:04:06,980 --> 00:04:11,318
They are both the same region of
the Lagoon Nebula, but they are

94
00:04:11,318 --> 00:04:14,721
looking at it with different
kinds of light so Hubble can see

95
00:04:14,721 --> 00:04:17,491
both visible light like our eyes
can see and that's what we can

96
00:04:17,491 --> 00:04:21,661
see here on the left and also
infrared light which is what you

97
00:04:21,661 --> 00:04:23,163
see here on the right.

98
00:04:23,163 --> 00:04:26,266
And so infrared light we can
actually see through a lot of

99
00:04:26,266 --> 00:04:30,604
the dusty veil in front
of and within the nebula.

100
00:04:30,604 --> 00:04:35,208
You can see a lot of
stars behind it you can see

101
00:04:35,208 --> 00:04:36,943
some stars within the nebula.

102
00:04:36,943 --> 00:04:39,379
And you can see these very dark
globules where new smaller stars

103
00:04:39,379 --> 00:04:42,916
are still incubating so it's
wonderful to have Hubble's

104
00:04:42,916 --> 00:04:45,652
panchromatic view of all
these different colors.

105
00:04:45,652 --> 00:04:47,287
It gives us
different information.

106
00:04:47,287 --> 00:04:48,155
ERIN: That's amazing.

107
00:04:48,155 --> 00:04:50,123
And so how far

away about is this?

108
00:04:50,123 --> 00:04:55,295
JENNIFER: So the nebula is about
4,000 lightyears away, that's a

109
00:04:55,295 --> 00:04:58,031
unit of distance that we use
that basically means that the

110
00:04:58,031 --> 00:05:01,401
light started its journey
to us about 4,000 years ago.

111
00:05:01,401 --> 00:05:03,737
Think about what was happening
on Earth at that time and that's

112
00:05:03,737 --> 00:05:05,472
when the light
started traveling to us.

113
00:05:05,472 --> 00:05:08,708
ERIN: That is
extremely impressive.

114
00:05:08,708 --> 00:05:11,545
For our viewers at home we are
at NASA Goddard Space Flight

115
00:05:11,545 --> 00:05:14,514
Center inside the Hubble Space
Telescope Operations Control

116
00:05:14,514 --> 00:05:18,151
Center and now I'm going to jump
over and ask someone really cool

117
00:05:18,151 --> 00:05:19,986
to speak with me

if he has a second.

118
00:05:19,986 --> 00:05:22,255
We've got systems
engineer Mike Wenz.

119
00:05:22,255 --> 00:05:23,123
Hi.

120
00:05:23,123 --> 00:05:24,624
Thank you so much
for being here.

121
00:05:24,624 --> 00:05:26,560
MIKE: Hi, Erin.

122
00:05:26,560 --> 00:05:28,328
You are perfectly welcome.

123
00:05:28,328 --> 00:05:30,063
ERIN: So can you tell us a
little bit about what goes on in

124
00:05:30,063 --> 00:05:30,764
this room?

125
00:05:30,764 --> 00:05:32,098
MIKE: Yeah, this is
actually the room where we

126
00:05:32,098 --> 00:05:33,433
control the Hubble
Space Telescope.

127
00:05:33,433 --> 00:05:35,936
We'll send commands up to it
and we'll also receive telemetry

128
00:05:35,936 --> 00:05:38,305

down from it so we can actually
see how the instruments are

129
00:05:38,305 --> 00:05:40,407
doing and how the
telescope is doing.

130
00:05:40,407 --> 00:05:44,010
In this room right here, this is
where the systems engineers will

131
00:05:44,010 --> 00:05:46,079
work for various circumstances.

132
00:05:46,079 --> 00:05:48,582
This is actually where we did
support the servicing missions

133
00:05:48,582 --> 00:05:51,251
that Jim talked about where we
were replacing the instruments

134
00:05:51,251 --> 00:05:54,421
on Hubble that was a lot of
fun working with the astronauts.

135
00:05:54,421 --> 00:05:57,557
But we use this room now
mainly for two reasons one of

136
00:05:57,557 --> 00:06:00,293
them is if we have some sort of
anomaly on the spacecraft which

137
00:06:00,293 --> 00:06:02,229
is when the spacecraft does
something we weren't quite

138
00:06:02,229 --> 00:06:05,732
expecting and so the system

engineers here try to figure out

139
00:06:05,732 --> 00:06:08,835
what's going on and why it
happened and what can we do to

140
00:06:08,835 --> 00:06:10,570
make it not happen again.

141
00:06:10,570 --> 00:06:13,106
We also use this room for
testing if we are going to be

142
00:06:13,106 --> 00:06:16,276
sending up new software to the
instruments or new software to

143
00:06:16,276 --> 00:06:16,943
the telescope.

144
00:06:16,943 --> 00:06:19,346
We gotta make sure we test it
out on the ground beforehand

145
00:06:19,346 --> 00:06:21,314
because you don't want to be
testing it out

146
00:06:21,314 --> 00:06:21,982
on the spacecraft itself.

147
00:06:21,982 --> 00:06:25,318
ERIN: Ok,
so trick question!

148
00:06:25,318 --> 00:06:29,923
What is something that Hubble
do that would fall under that

149

00:06:29,923 --> 00:06:31,191
unexpected category?

150
00:06:31,191 --> 00:06:35,295
MIKE: One of the small
anomalies that we have fairly

151
00:06:35,295 --> 00:06:38,231
recently that we have once,
maybe even twice a week is there

152
00:06:38,231 --> 00:06:40,700
is instruments on the Hubble
that allow us to point the

153
00:06:40,700 --> 00:06:42,002
telescope very accurately.

154
00:06:42,002 --> 00:06:45,405
To be able to take the images
that Jennifer was talking about

155
00:06:45,405 --> 00:06:48,341
have to be able to point and
hold the telescope extremely

156
00:06:48,341 --> 00:06:50,810
accurately in fact we have to
able to focus on essentially on

157
00:06:50,810 --> 00:06:53,546
the width of a human hair
held at one mile distance.

158
00:06:53,546 --> 00:06:56,483
To be able to do that is
instruments that we have fine

159
00:06:56,483 --> 00:06:57,817
guidance sensors.

160
00:06:57,817 --> 00:06:59,219
They lock up on stars.

161
00:06:59,219 --> 00:07:01,588
They actually find the stars
and they lock and they hold it.

162
00:07:01,588 --> 00:07:04,391
But every once in a while
they'll try to lock up on a star

163
00:07:04,391 --> 00:07:07,427
and they can't do it and they
send information

164
00:07:07,427 --> 00:07:08,094
down saying we can't do it.

165
00:07:08,094 --> 00:07:12,932
So we have to come in here and
we find that they are actually

166
00:07:12,932 --> 00:07:17,270
lock up on single stars and that
they aren't single stars but we

167
00:07:17,270 --> 00:07:18,705
don't know about it
on the ground yet.

168
00:07:18,705 --> 00:07:21,574
No one on the ground can tell
that these are double stars or

169
00:07:21,574 --> 00:07:24,277
binary stars and Hubble
makes these discoveries when it

170

00:07:24,277 --> 00:07:25,912
actually has these anomalies.

171
00:07:25,912 --> 00:07:29,049
ERIN: That's
quite the silver lining.

172
00:07:29,049 --> 00:07:29,949
So how about you?

173
00:07:29,949 --> 00:07:31,384
What is your role?

174
00:07:31,384 --> 00:07:32,752
How long have you been
working with Hubble?

175
00:07:32,752 --> 00:07:34,254
MIKE: I'm a
systems engineer here.

176
00:07:34,254 --> 00:07:36,256
I've actually been on
Hubble for 26 years.

177
00:07:36,256 --> 00:07:39,592
I'm one of the older guys around
who've been

178
00:07:39,592 --> 00:07:40,493
around here for a lot of it.

179
00:07:40,493 --> 00:07:43,697
I'm actually in charge of those
fine guidance sensors and those

180
00:07:43,697 --> 00:07:46,833
are actually the instruments
that I have to take care of.

181
00:07:46,833 --> 00:07:48,902
I actually am the one who gets
to come in here and find all the

182
00:07:48,902 --> 00:07:51,037
double stars and variable stars
that Hubble has found because

183
00:07:51,037 --> 00:07:51,705
it's had trouble.

184
00:07:51,705 --> 00:07:53,540
ERIN:
That's an amazing job.

185
00:07:53,540 --> 00:07:54,808
I'll let you get back to work.

186
00:07:54,808 --> 00:07:56,142
Thank you so much for your time.

187
00:07:56,142 --> 00:07:56,810
MIKE: Thank you.

188
00:07:56,810 --> 00:07:58,511
ERIN: Alright, so we are
going to start taking some of

189
00:07:58,511 --> 00:07:59,479
your questions.

190
00:07:59,479 --> 00:08:00,647
Continue to send them in.

191
00:08:00,647 --> 00:08:04,084
We're going to be taking them
here and also after the show is

192

00:08:04,084 --> 00:08:06,453
over we'll be answering them
in the comments section below.

193
00:08:06,453 --> 00:08:09,322
Let's see what we've got here.

194
00:08:09,322 --> 00:08:13,693
So Tia from Twitter asks: how
do you deal with damages made by

195
00:08:13,693 --> 00:08:17,063
impacts from space
objects on Hubble?

196
00:08:17,063 --> 00:08:18,398
That's an interesting one, do
you want to take that one Jim?

197
00:08:18,398 --> 00:08:19,065
JIM: Sure.

198
00:08:19,065 --> 00:08:20,400
It's a great question we
actually look for major impacts

199
00:08:20,400 --> 00:08:21,768
so that we can actually turn
the telescope to be as small of

200
00:08:21,768 --> 00:08:23,103
surface area as possible so
they'll avoid us if we know

201
00:08:23,103 --> 00:08:24,437
one's coming or if
it's big enough.

202
00:08:24,437 --> 00:08:25,772
But for the most part it gets

hit and so far I think we've

203
00:08:25,772 --> 00:08:27,107
been really lucky in that
nothing has hit us that has

204
00:08:27,107 --> 00:08:28,441
caused anything really to break.

205
00:08:28,441 --> 00:08:29,809
We are going to keep our fingers
crossed here for the next

206
00:08:29,809 --> 00:08:30,477
however many years.

207
00:08:30,477 --> 00:08:31,144
ERIN: Long live Hubble.

208
00:08:31,144 --> 00:08:32,479
Alright, so Dan asks: what's
the furthest point in lightyears

209
00:08:32,479 --> 00:08:33,146
that Hubble has seen?

210
00:08:33,146 --> 00:08:34,481
I'll leave that
to you, Jennifer.

211
00:08:34,481 --> 00:08:35,849
JENNIFER: That's a very
good question, so we're trying

212
00:08:35,849 --> 00:08:40,854
to see objects in space farther
and farther out, the cameras on

213
00:08:43,056 --> 00:08:49,362

Hubble have improved over the
years because of these astronaut

214
00:08:49,362 --> 00:08:54,367
servicing missions we've
had more sensitivities.

215
00:09:14,587 --> 00:09:18,925
So right now we're seeing
emission in galaxies in the very

216
00:09:18,925 --> 00:09:25,765
distant universe that are in the
process of forming more than 13

217
00:09:25,765 --> 00:09:27,033
billion lightyears away.

218
00:09:27,033 --> 00:09:30,837
So we know the universe
seems to be about 13.8 billion

219
00:09:30,837 --> 00:09:36,176
years old and we're seeing these
baby galaxies form within the

220
00:09:36,176 --> 00:09:39,479
first point eight of these 13.8
billion years in fact within the

221
00:09:39,479 --> 00:09:42,315
first few hundred million
years we are seeing these infant

222
00:09:42,315 --> 00:09:44,084
galaxies start to form.

223
00:09:44,084 --> 00:09:47,086
And the upcoming James Webb
Space Telescope will be able to

224
00:09:47,086 --> 00:09:50,623
see even farther because it has
infrared capabilities and will

225
00:09:50,623 --> 00:09:54,360
be able to see even farther
back into time as light travels

226
00:09:54,360 --> 00:09:57,397
through this expanding universe
and gets stretched into redder

227
00:09:57,397 --> 00:09:58,898
and redder wavelengths of light.

228
00:09:58,898 --> 00:10:00,133
ERIN: Thanks.

229
00:10:00,133 --> 00:10:02,469
Alright, let's see
what we've got next.

230
00:10:02,469 --> 00:10:06,739
On that same note, what has
Hubble found out about the

231
00:10:06,739 --> 00:10:08,274
beginning of the universe?

232
00:10:08,274 --> 00:10:11,878
JENNIFER: Well, Hubble
cannot see all the way back to

233
00:10:11,878 --> 00:10:13,046
the beginning.

234
00:10:13,046 --> 00:10:18,151
There's a time before radiation

could even escape for us to see.

235
00:10:18,151 --> 00:10:19,853
But we are able to
see pretty close.

236
00:10:19,853 --> 00:10:24,190
Like I said, the first point
eight of the 13.8 billion year

237
00:10:24,190 --> 00:10:27,894
history of the universe and what
we've learned is that galaxies

238
00:10:27,894 --> 00:10:29,863
formed early on.

239
00:10:29,863 --> 00:10:33,333
Galaxies are collections of
stars and gas and dark matter.

240
00:10:33,333 --> 00:10:37,537
Stars formed early on
these gravitational collections

241
00:10:37,537 --> 00:10:41,407
of material grew over time and
we can now see with Hubble by

242
00:10:41,407 --> 00:10:46,179
looking far out in space, which
means looking back in time, that

243
00:10:46,179 --> 00:10:49,482
galaxies were once quite small
and and irregular looking and

244
00:10:49,482 --> 00:10:53,553
they merged together many times
to grow into the bigger type

245
00:10:53,553 --> 00:10:55,522
galaxies like the Milky Way.

246
00:10:55,522 --> 00:10:58,658
So we've been able to see
with Hubble that galaxies began

247
00:10:58,658 --> 00:11:03,096
small, they grew over time,
and now we have the privilege of

248
00:11:03,096 --> 00:11:08,434
several generations of stars,
massive stars, that come and go

249
00:11:08,434 --> 00:11:11,671
and that gives us heavier
elements like carbon and oxygen

250
00:11:11,671 --> 00:11:13,840
things we need for
planets and life.

251
00:11:13,840 --> 00:11:15,842
ERIN: Thank you so much.

252
00:11:15,842 --> 00:11:18,678
Unfortunately, I think we're
going to have to get out of here

253
00:11:18,678 --> 00:11:20,246
and let these folks
get back to work.

254
00:11:20,246 --> 00:11:22,815
But I want to thank you all for
joining us and please continue

255

00:11:22,815 --> 00:11:23,816
to send in your questions.

256
00:11:23,816 --> 00:11:26,386
We'll get to some of them in
the comments section below.

257
00:11:26,386 --> 00:11:28,888
Take one last look at the room
around us before you leave and

258
00:11:28,888 --> 00:11:31,257
if you want to know anything
more about Hubble you can always

259
00:11:31,257 --> 00:11:35,695
find on nasa.gov/hubble or
NASA Social Media @NASAHubble.

260
00:11:35,695 --> 00:11:37,063
Thank you both so
much for being here.

261
00:11:37,063 --> 00:11:42,068
Let's get on out of here.