1
00:00:01,300 --> 00:00:06,550
[Music]

2
00:00:12,310 --> 00:00:10,070
hi i'm ellen stofan also known as dr e

3
00:00:14,150 --> 00:00:12,320
the john and adrian mars director of the

4
00:00:15,910 --> 00:00:14,160
smithsonian's national air and space

5
00:00:17,590 --> 00:00:15,920
museum and i'm thomas serbic and the

6
00:00:21,189 --> 00:00:17,600
associate administrator for science at

7
00:00:23,349 --> 00:00:21,199
nasa also known as dr z and we're both

8
00:00:25,429 --> 00:00:23,359
in our home offices uh just like

9
00:00:27,029 --> 00:00:25,439
everybody else we're with our families

10
00:00:29,349 --> 00:00:27,039
and it's kind of a difficult time for

11
00:00:31,910 --> 00:00:29,359
all of us so we're thinking about people

12
00:00:34,310 --> 00:00:31,920
out there in the same kind of situation

13
00:00:37,030 --> 00:00:34,320

but see science never sleeps and we want

14
00:00:39,350 --> 00:00:37,040
to share amazing stories with you even

15
00:00:41,510 --> 00:00:39,360
now and thomas we have a great one for

16
00:00:43,910 --> 00:00:41,520
today because we're coming up on a

17
00:00:46,229 --> 00:00:43,920
really important anniversary it's the

18
00:00:49,110 --> 00:00:46,239
30th anniversary of the hubble space

19
00:00:52,229 --> 00:00:49,120
telescope which launched on april 24th

20
00:00:54,150 --> 00:00:52,239
1990. so let's start with the science

21
00:00:56,869 --> 00:00:54,160
impact for me it's kind of about three

22
00:01:00,630 --> 00:00:56,879
numbers the first number is

23
00:01:02,750 --> 00:01:00,640
15 000 plus publications to date the

24
00:01:06,630 --> 00:01:02,760
second one is

25
00:01:09,910 --> 00:01:06,640
160 terabytes of data and the third

26
00:01:12,230 --> 00:01:09,920
number is over 12 000 active users and

27
00:01:13,510 --> 00:01:12,240
and frankly that's just stunning uh

28
00:01:16,310 --> 00:01:13,520
right ellen

29
00:01:18,550 --> 00:01:16,320
it really is and and it it's just again

30
00:01:19,990 --> 00:01:18,560
it's always hard for me to to explain to

31
00:01:22,310 --> 00:01:20,000
people how much

32
00:01:25,109 --> 00:01:22,320
hubble changed and when you think back

33
00:01:26,469 --> 00:01:25,119
across the discoveries it's made it's

34
00:01:28,710 --> 00:01:26,479
really unbelievable

35
00:01:31,429 --> 00:01:28,720
and so i think of the fact that hubble

36
00:01:32,950 --> 00:01:31,439
discovered two of the moons of pluto and

37
00:01:34,710 --> 00:01:32,960
of course the fact that hubble was

38
00:01:37,830 --> 00:01:34,720

actually instrumental in discovering a

39
00:01:40,870 --> 00:01:37,840
number of exoplanets i asked people to

40
00:01:43,429 --> 00:01:40,880
close their eyes and think about the

41
00:01:45,910 --> 00:01:43,439
word galaxy and ask them which image did

42
00:01:48,310 --> 00:01:45,920
you see and you know in nine out of ten

43
00:01:51,670 --> 00:01:48,320
people everywhere they see a hubble

44
00:01:54,710 --> 00:01:51,680
image galaxies of the deep exposure the

45
00:01:56,469 --> 00:01:54,720
andromeda nebula they see the orion

46
00:01:59,350 --> 00:01:56,479
nebula some of these images that are

47
00:02:01,109 --> 00:01:59,360
iconic and will forever be how we think

48
00:02:03,270 --> 00:02:01,119
about the universe but let's switch

49
00:02:06,550 --> 00:02:03,280
quickly to the people let's talk about

50
00:02:08,309 --> 00:02:06,560
nancy grace roman did you know her

51
00:02:11,270 --> 00:02:08,319
you know i never met her but what an

52
00:02:13,830 --> 00:02:11,280
amazing career and frankly the amount of

53
00:02:16,070 --> 00:02:13,840
pushback she had every step of her

54
00:02:17,589 --> 00:02:16,080
career and yet she persevered from the

55
00:02:19,910 --> 00:02:17,599
fact that when she got hired she got

56
00:02:21,830 --> 00:02:19,920
hired at a way lower salary than she

57
00:02:24,390 --> 00:02:21,840
should have to the fact she had to fight

58
00:02:26,470 --> 00:02:24,400
every step of the way but she knew if we

59
00:02:27,750 --> 00:02:26,480
could put a telescope above the

60
00:02:29,830 --> 00:02:27,760
atmosphere

61
00:02:32,150 --> 00:02:29,840
that what it would discover would change

62
00:02:34,070 --> 00:02:32,160
the world and she was rife

63
00:02:36,229 --> 00:02:34,080

for many of us and for the whole

64
00:02:38,790 --> 00:02:36,239
community she's really considered the

65
00:02:40,869 --> 00:02:38,800
mother of hubble

66
00:02:42,790 --> 00:02:40,879
i recently got to hear kathy sullivan

67
00:02:44,710 --> 00:02:42,800
another amazing woman and of course she

68
00:02:46,790 --> 00:02:44,720
was the astronaut that was responsible

69
00:02:48,790 --> 00:02:46,800
for deploying the hubble space telescope

70
00:02:51,750 --> 00:02:48,800
on that discovery flight that was led by

71
00:02:54,949 --> 00:02:51,760
charlie bolden she was talking about how

72
00:02:57,190 --> 00:02:54,959
it was such genius to make that

73
00:02:59,350 --> 00:02:57,200
telescope serviceable

74
00:03:01,750 --> 00:02:59,360
by the astronauts i don't think anybody

75
00:03:03,350 --> 00:03:01,760
thought it would last as long as it has

76
00:03:05,350 --> 00:03:03,360
you know and of course they didn't know

77
00:03:06,949 --> 00:03:05,360
the trouble with hubble and the fact

78
00:03:09,750 --> 00:03:06,959
there was a fundamental flaw in the

79
00:03:12,390 --> 00:03:09,760
mirror but the brilliance of making that

80
00:03:14,550 --> 00:03:12,400
accessible by the space shuttle making

81
00:03:15,910 --> 00:03:14,560
the instruments able to be removed and

82
00:03:19,350 --> 00:03:15,920
replaced

83
00:03:21,670 --> 00:03:19,360
that really allowed hubble to triumph

84
00:03:23,190 --> 00:03:21,680
over incredible challenges

85
00:03:25,270 --> 00:03:23,200
i think of the times i've gotten to talk

86
00:03:27,190 --> 00:03:25,280
with john grunsfeld another mutual

87
00:03:29,030 --> 00:03:27,200
friend of ours an astronaut who was on

88
00:03:31,190 --> 00:03:29,040

many of the repair missions and as an

89
00:03:33,509 --> 00:03:31,200
astrophysicist himself

90
00:03:35,670 --> 00:03:33,519
getting to go up and actually help

91
00:03:38,229 --> 00:03:35,680
keep this telescope not just alive but

92
00:03:40,390 --> 00:03:38,239
have it excel to do things like

93
00:03:43,430 --> 00:03:40,400
really change our view of the universe

94
00:03:45,910 --> 00:03:43,440
with dark energy dark matter looking at

95
00:03:47,830 --> 00:03:45,920
black holes at the centers of galaxies i

96
00:03:49,990 --> 00:03:47,840
i mean the list just goes on and on

97
00:03:51,670 --> 00:03:50,000
about what hubble has achieved and i

98
00:03:54,309 --> 00:03:51,680
will say i want to give a huge shout out

99
00:03:56,229 --> 00:03:54,319
to the team right now and in fact we

100
00:03:57,750 --> 00:03:56,239
awarded them our our michael collins

101
00:03:59,429 --> 00:03:57,760
trophy at the air and space museum

102
00:04:01,750 --> 00:03:59,439
because this amazing achievement they're

103
00:04:04,309 --> 00:04:01,760
still getting data out of what we might

104
00:04:06,309 --> 00:04:04,319
say is a slightly elderly telescope with

105
00:04:08,470 --> 00:04:06,319
a few you know think of it as maybe an

106
00:04:11,190 --> 00:04:08,480
old person with some creaky joints the

107
00:04:13,830 --> 00:04:11,200
team just keeps finding ways to make

108
00:04:16,789 --> 00:04:13,840
that telescope keep going make the data

109
00:04:19,430 --> 00:04:16,799
keep flowing there are these amazing

110
00:04:21,670 --> 00:04:19,440
teams that are just really what in my

111
00:04:24,230 --> 00:04:21,680
opinion exploration is all about yes

112
00:04:25,430 --> 00:04:24,240
it's about the key ideas it's about

113
00:04:27,189 --> 00:04:25,440

these other

114
00:04:29,749 --> 00:04:27,199
individuals that bring their heart and

115
00:04:31,749 --> 00:04:29,759
soul to bear and make these missions

116
00:04:33,430 --> 00:04:31,759
happen it's the perseverance and tough

117
00:04:35,749 --> 00:04:33,440
times and i really want to thank them

118
00:04:38,070 --> 00:04:35,759
for that and of course thomas right now

119
00:04:40,230 --> 00:04:38,080
we're also really excited that not only

120
00:04:42,950 --> 00:04:40,240
are we still going to have hubble but

121
00:04:44,950 --> 00:04:42,960
we're now actually about to get the next

122
00:04:47,510 --> 00:04:44,960
great observatory the james webb space

123
00:04:49,990 --> 00:04:47,520
telescope can you imagine that we have

124
00:04:52,550 --> 00:04:50,000
this other telescope that is

125
00:04:55,990 --> 00:04:52,560
in many ways a successor of hubble

126
00:04:58,310 --> 00:04:56,000
looking at deeper universe with colder

127
00:05:00,469 --> 00:04:58,320
detectors with technologies the world

128
00:05:03,430 --> 00:05:00,479
has never seen and and it's getting

129
00:05:06,390 --> 00:05:03,440
ready right now over there in california

130
00:05:08,070 --> 00:05:06,400
it's all together as one and next year

131
00:05:10,550 --> 00:05:08,080
is the year we're going to launch this

132
00:05:11,830 --> 00:05:10,560
telescope we're so excited thomas you

133
00:05:13,749 --> 00:05:11,840
know we have actually a bunch of

134
00:05:16,550 --> 00:05:13,759
questions that have come in from the

135
00:05:19,189 --> 00:05:16,560
public one of the questions we got was

136
00:05:20,710 --> 00:05:19,199
we know the universe is expanding but

137
00:05:23,189 --> 00:05:20,720
why are

138
00:05:25,830 --> 00:05:23,199

the two galaxies and they were referring

139
00:05:27,909 --> 00:05:25,840
to the upcoming collision of the milky

140
00:05:29,990 --> 00:05:27,919
way galaxy with the andromeda galaxy

141
00:05:32,629 --> 00:05:30,000
don't worry it's not for a long time why

142
00:05:35,110 --> 00:05:32,639
are these two galaxies converging if

143
00:05:36,710 --> 00:05:35,120
everything's moving away that's really

144
00:05:38,790 --> 00:05:36,720
amazing fact the first one yes the

145
00:05:40,230 --> 00:05:38,800
universe is expanding and frankly that's

146
00:05:42,629 --> 00:05:40,240
one of the reasons

147
00:05:44,469 --> 00:05:42,639
hubble space telescope was built

148
00:05:46,870 --> 00:05:44,479
to measure those expansions at an

149
00:05:48,710 --> 00:05:46,880
accuracy we now know that we never

150
00:05:51,110 --> 00:05:48,720
expected we actually learned that the

151
00:05:53,029 --> 00:05:51,120
expansion is even getting faster that's

152
00:05:55,430 --> 00:05:53,039
also one of the results in part from

153
00:05:56,790 --> 00:05:55,440
hubble it is true that those galaxies

154
00:05:59,270 --> 00:05:56,800
those neighboring galaxies are

155
00:06:01,670 --> 00:05:59,280
attracting each other and frankly

156
00:06:03,590 --> 00:06:01,680
they're converging because of gravity

157
00:06:05,510 --> 00:06:03,600
the same force that keeps us to the

158
00:06:07,350 --> 00:06:05,520
earth or makes the apple fall is the

159
00:06:10,629 --> 00:06:07,360
force that makes the milky way and

160
00:06:12,469 --> 00:06:10,639
andromeda converge so hubble teaches us

161
00:06:14,710 --> 00:06:12,479
both about the expansion of the entire

162
00:06:16,550 --> 00:06:14,720
universe but also the convergence of

163
00:06:19,110 --> 00:06:16,560

those two neighboring galaxies because

164
00:06:21,029 --> 00:06:19,120
of gravity this is a fun question for

165
00:06:22,870 --> 00:06:21,039
right now what is the most exciting

166
00:06:25,510 --> 00:06:22,880
possibility of what we'll learn with the

167
00:06:27,670 --> 00:06:25,520
james webb space telescope i really do

168
00:06:30,150 --> 00:06:27,680
believe that one of the most exciting

169
00:06:33,270 --> 00:06:30,160
parts is to get the atmospheres of

170
00:06:35,510 --> 00:06:33,280
exoplanets analyzed in new ways

171
00:06:37,990 --> 00:06:35,520
our hope is to learn about the

172
00:06:40,790 --> 00:06:38,000
possibilities of these exoplanets to

173
00:06:42,550 --> 00:06:40,800
harbor life to really have similarities

174
00:06:43,510 --> 00:06:42,560
to the planets that we have around here

175
00:06:45,350 --> 00:06:43,520
how would you have answered that

176
00:06:47,670 --> 00:06:45,360
question ellen same way

177
00:06:49,830 --> 00:06:47,680
you know for me you know i know and and

178
00:06:51,670 --> 00:06:49,840
i'm not doing justice to all the amazing

179
00:06:53,990 --> 00:06:51,680
things that webb is going to do and in

180
00:06:55,749 --> 00:06:54,000
fact it's going to even look back

181
00:06:57,350 --> 00:06:55,759
further in the history of the universe

182
00:06:58,870 --> 00:06:57,360
than hubble's been able to we know

183
00:07:01,589 --> 00:06:58,880
hubble's been able to help us understand

184
00:07:04,150 --> 00:07:01,599
that the universe is about 13.75 billion

185
00:07:05,990 --> 00:07:04,160
years old but because web is a more

186
00:07:07,830 --> 00:07:06,000
powerful telescope it's actually going

187
00:07:09,990 --> 00:07:07,840
to be able to see

188
00:07:11,270 --> 00:07:10,000

back to within tens of millions of years

189
00:07:13,749 --> 00:07:11,280
of the big bang

190
00:07:17,350 --> 00:07:13,759
we're just about out of time i've really

191
00:07:19,510 --> 00:07:17,360
enjoyed this at home easy science uh

192
00:07:21,670 --> 00:07:19,520
talking about the 30th anniversary of

193
00:07:22,870 --> 00:07:21,680
the hubble space telescope but the many

194
00:07:24,629 --> 00:07:22,880
questions

195
00:07:26,790 --> 00:07:24,639
that come from this

196
00:07:28,950 --> 00:07:26,800
this has been fun thanks for joining us

197
00:07:32,740 --> 00:07:28,960
and we can't wait for the next episode