1
00:00:06,230 --> 00:00:05,910
[Music]

2
00:00:09,430 --> 00:00:06,240
hi

3
00:00:11,430 --> 00:00:09,440
i'm dr ellen stofan also known as dr e

4
00:00:13,589 --> 00:00:11,440
and i'm dr thomas cerbo and also known

5
00:00:15,430 --> 00:00:13,599
as dr z and we're here with another

6
00:00:17,430 --> 00:00:15,440
episode of easy science

7
00:00:19,510 --> 00:00:17,440
focused on the science of the next

8
00:00:22,470 --> 00:00:19,520
mission to mars called perseverance

9
00:00:23,189 --> 00:00:22,480
before we get there tell us about where

10
00:00:25,429 --> 00:00:23,199
we are

11
00:00:27,189 --> 00:00:25,439
so we're at the stephen f varhazi center

12
00:00:28,390 --> 00:00:27,199
which is one of our two national air and

13
00:00:30,630 --> 00:00:28,400

space museums

14
00:00:32,229 --> 00:00:30,640
but we're back behind the scenes of the

15
00:00:33,830 --> 00:00:32,239
museum actually this is what's called

16
00:00:35,670 --> 00:00:33,840
the dulles collection center

17
00:00:37,430 --> 00:00:35,680
it's where we store aircraft and

18
00:00:38,869 --> 00:00:37,440
spacecraft that we don't have room for

19
00:00:40,630 --> 00:00:38,879
out on the floor partially because we're

20
00:00:41,270 --> 00:00:40,640
renovating our building on the national

21
00:00:42,950 --> 00:00:41,280
mall

22
00:00:44,470 --> 00:00:42,960
but it's also where we get new

23
00:00:46,630 --> 00:00:44,480
acquisitions we come in

24
00:00:48,709 --> 00:00:46,640
make sure they're in good condition in

25
00:00:50,630 --> 00:00:48,719
the case of this guy this is the test

26
00:00:52,630 --> 00:00:50,640
bed rover that was used for the spirit

27
00:00:53,270 --> 00:00:52,640
and opportunity rovers so it's an exact

28
00:00:54,630 --> 00:00:53,280
copy

29
00:00:57,189 --> 00:00:54,640
one of the things we're having to work

30
00:00:58,950 --> 00:00:57,199
on with our conservators is not to clean

31
00:01:01,830 --> 00:00:58,960
all the red dust off of it

32
00:01:04,229 --> 00:01:01,840
because jpl had this operating in a test

33
00:01:05,109 --> 00:01:04,239
bed that exactly simulated the martian

34
00:01:07,350 --> 00:01:05,119
surface

35
00:01:08,390 --> 00:01:07,360
so that red dust on this is earth dust

36
00:01:10,870 --> 00:01:08,400
but it's history

37
00:01:13,190 --> 00:01:10,880
what did we learn from a spirit an

38
00:01:16,230 --> 00:01:13,200

opportunity that really set us up

39
00:01:17,670 --> 00:01:16,240
to do perseverance so with all of our

40
00:01:19,429 --> 00:01:17,680
orbiters and rovers

41
00:01:21,030 --> 00:01:19,439
that nasa as well as the international

42
00:01:22,230 --> 00:01:21,040
community has had at mars

43
00:01:24,230 --> 00:01:22,240
we've really been doing something that

44
00:01:26,070 --> 00:01:24,240
we like to call follow the water

45
00:01:27,910 --> 00:01:26,080
and spirit and opportunity really laid

46
00:01:30,469 --> 00:01:27,920
the groundwork of understanding

47
00:01:31,429 --> 00:01:30,479
very early in mars's history mars was

48
00:01:33,109 --> 00:01:31,439
wet and

49
00:01:34,950 --> 00:01:33,119
you don't only want to know that mars

50
00:01:36,469 --> 00:01:34,960
was wet if you're thinking about could

51
00:01:38,230 --> 00:01:36,479
mars have hosted life

52
00:01:40,950 --> 00:01:38,240
you're also really asking questions

53
00:01:42,950 --> 00:01:40,960
about how long did the water stay

54
00:01:44,069 --> 00:01:42,960
what kind of water was it very acidic

55
00:01:47,270 --> 00:01:44,079
was it very basic

56
00:01:49,830 --> 00:01:47,280
were the conditions conducive to life

57
00:01:51,030 --> 00:01:49,840
and spirit and opportunity really set us

58
00:01:53,990 --> 00:01:51,040
on the path

59
00:01:55,109 --> 00:01:54,000
yes there was water yes it persisted for

60
00:01:57,429 --> 00:01:55,119
quite some time

61
00:01:59,030 --> 00:01:57,439
so in february mid-february next year

62
00:02:00,310 --> 00:01:59,040
we're going to land in a place called

63
00:02:03,270 --> 00:02:00,320

jazz row crater

64
00:02:03,910 --> 00:02:03,280
28 miles in diameter now talk to us

65
00:02:06,069 --> 00:02:03,920
about

66
00:02:07,510 --> 00:02:06,079
the environment of that crater why is

67
00:02:11,270 --> 00:02:07,520
that the right place to go

68
00:02:14,150 --> 00:02:11,280
so with our orbiters above we looked for

69
00:02:15,589 --> 00:02:14,160
minerals types of rock that we know are

70
00:02:18,630 --> 00:02:15,599
associated with water

71
00:02:20,390 --> 00:02:18,640
in this case clays so people have clay

72
00:02:21,110 --> 00:02:20,400
in their backyard you know it's a heavy

73
00:02:23,830 --> 00:02:21,120
wet

74
00:02:26,070 --> 00:02:23,840
type of material okay we've found a lot

75
00:02:27,510 --> 00:02:26,080
of clays in jezreel crater we know at

76
00:02:29,430 --> 00:02:27,520
one point in time

77
00:02:31,589 --> 00:02:29,440
there was probably a river flowing into

78
00:02:34,309 --> 00:02:31,599
it there were lake deposits so we know

79
00:02:36,229 --> 00:02:34,319
it wasn't only just wet but that water

80
00:02:38,710 --> 00:02:36,239
was there for a long period of time

81
00:02:40,470 --> 00:02:38,720
so it's the perfect place to go to get

82
00:02:42,550 --> 00:02:40,480
to this next step of

83
00:02:44,309 --> 00:02:42,560
okay we know mars was wet we know it had

84
00:02:46,229 --> 00:02:44,319
water for a long time

85
00:02:47,830 --> 00:02:46,239
were the conditions conducive to the

86
00:02:49,589 --> 00:02:47,840
evolution of life

87
00:02:51,030 --> 00:02:49,599
that's really exciting and you know the

88
00:02:53,589 --> 00:02:51,040

one thing i also learned from

89
00:02:54,790 --> 00:02:53,599
researchers just like you is when you

90
00:02:57,190 --> 00:02:54,800
land there there's

91
00:02:59,750 --> 00:02:57,200
many different what they call geological

92
00:03:01,990 --> 00:02:59,760
units many different parts of the

93
00:03:03,430 --> 00:03:02,000
mars history within driving distance

94
00:03:06,070 --> 00:03:03,440
which really allows us to

95
00:03:07,830 --> 00:03:06,080
take samples of that mars history and

96
00:03:08,949 --> 00:03:07,840
really bottle it up and bring it back to

97
00:03:10,550 --> 00:03:08,959
the best labs

98
00:03:12,710 --> 00:03:10,560
that we have available which are the

99
00:03:13,990 --> 00:03:12,720
labs here on earth each of those layers

100
00:03:16,309 --> 00:03:14,000
of rock in that crater

101
00:03:18,790 --> 00:03:16,319
are like pages in a history book so each

102
00:03:21,350 --> 00:03:18,800
one preserves a specific amount of time

103
00:03:22,869 --> 00:03:21,360
the type of rock and the chemistry of

104
00:03:25,270 --> 00:03:22,879
those rocks really tells you

105
00:03:26,070 --> 00:03:25,280
what was mars like at that exact point

106
00:03:27,670 --> 00:03:26,080
in time

107
00:03:29,589 --> 00:03:27,680
so the perseverance rover is going to

108
00:03:30,550 --> 00:03:29,599
have all kinds of instruments on it

109
00:03:33,270 --> 00:03:30,560
that are really going to be

110
00:03:36,390 --> 00:03:33,280
interrogating each of those rock layers

111
00:03:39,190 --> 00:03:36,400
and saying what happened when here's a

112
00:03:41,270 --> 00:03:39,200
question we received from our audience

113
00:03:42,390 --> 00:03:41,280

will we have more sweater data from

114
00:03:44,470 --> 00:03:42,400
perseverance

115
00:03:47,030 --> 00:03:44,480
my war sweater report isn't very

116
00:03:48,550 --> 00:03:47,040
interesting from just one source

117
00:03:50,630 --> 00:03:48,560
just one source of course he's talking

118
00:03:52,309 --> 00:03:50,640
about inside right inside and we get a

119
00:03:53,910 --> 00:03:52,319
little bit of data from curiosity

120
00:03:55,270 --> 00:03:53,920
now mars has a lot more simple weather

121
00:03:56,070 --> 00:03:55,280
than the earth does but just think if

122
00:03:58,309 --> 00:03:56,080
you only had

123
00:03:59,990 --> 00:03:58,319
weather data from cleveland ohio and

124
00:04:01,750 --> 00:04:00,000
nowhere else on the planet when

125
00:04:03,509 --> 00:04:01,760
we're trying to understand whether and

126
00:04:04,390 --> 00:04:03,519
then the next step of understanding

127
00:04:06,149 --> 00:04:04,400
climate

128
00:04:07,830 --> 00:04:06,159
you really need to understand what's

129
00:04:09,670 --> 00:04:07,840
happening globally this is really

130
00:04:11,589 --> 00:04:09,680
important because studying weather and

131
00:04:13,670 --> 00:04:11,599
climate on other planets

132
00:04:15,670 --> 00:04:13,680
we turn around and use that information

133
00:04:16,390 --> 00:04:15,680
to help us improve weather and climate

134
00:04:18,229 --> 00:04:16,400
models

135
00:04:19,909 --> 00:04:18,239
here for our own planet it really helps

136
00:04:20,390 --> 00:04:19,919
to have something to compare this planet

137
00:04:22,230 --> 00:04:20,400
to

138
00:04:23,830 --> 00:04:22,240

so we're excited that perseverance is

139
00:04:26,390 --> 00:04:23,840
going to have a state-of-the-art

140
00:04:28,310 --> 00:04:26,400
sophisticated weather instrumentation

141
00:04:29,670 --> 00:04:28,320
measuring humidity wind temperature

142
00:04:31,189 --> 00:04:29,680
pressure all the kind of things we

143
00:04:31,909 --> 00:04:31,199
measure at a weather station here on

144
00:04:33,590 --> 00:04:31,919
earth

145
00:04:35,110 --> 00:04:33,600
so stay tuned and you'll start getting

146
00:04:35,830 --> 00:04:35,120
slightly better weather reports from

147
00:04:38,070 --> 00:04:35,840
mars

148
00:04:38,950 --> 00:04:38,080
that's really cool yeah it's just that

149
00:04:40,390 --> 00:04:38,960
this is just

150
00:04:42,310 --> 00:04:40,400
so many of the other instruments an

151
00:04:43,030 --> 00:04:42,320
internationally built instrument i think

152
00:04:44,950 --> 00:04:43,040
what we're

153
00:04:47,430 --> 00:04:44,960
often missing is we of course in the

154
00:04:49,990 --> 00:04:47,440
united states and nasa are fortunate to

155
00:04:51,830 --> 00:04:50,000
lead these missions but we have a number

156
00:04:53,350 --> 00:04:51,840
of international contributions including

157
00:04:55,270 --> 00:04:53,360
this one from spain

158
00:04:57,270 --> 00:04:55,280
amongst other countries that we're

159
00:04:59,350 --> 00:04:57,280
bringing there

160
00:05:00,870 --> 00:04:59,360
is there something about perseverance

161
00:05:03,029 --> 00:05:00,880
that you think this is

162
00:05:04,790 --> 00:05:03,039
i can't wait to find this out the

163
00:05:05,510 --> 00:05:04,800

question whether or not there's extinct

164
00:05:09,749 --> 00:05:05,520
life

165
00:05:12,230 --> 00:05:09,759
for me

166
00:05:14,230 --> 00:05:12,240
results that help us with that one way

167
00:05:17,430 --> 00:05:14,240
or the other frankly but help us

168
00:05:19,189 --> 00:05:17,440
understand that question better

169
00:05:20,790 --> 00:05:19,199
i've really enjoyed this discussion

170
00:05:22,790 --> 00:05:20,800
about the next mars

171
00:05:23,990 --> 00:05:22,800
rover called perseverance and what's

172
00:05:25,590 --> 00:05:24,000
really important to me

173
00:05:27,830 --> 00:05:25,600
when we think about perseverance is also

174
00:05:29,510 --> 00:05:27,840
the time we're in this has been a tough

175
00:05:31,189 --> 00:05:29,520
time for the teams that build

176
00:05:33,029 --> 00:05:31,199
perseverance but also

177
00:05:35,749 --> 00:05:33,039
for the whole world for a variety of

178
00:05:37,510 --> 00:05:35,759
reasons and there were perseverance

179
00:05:40,310 --> 00:05:37,520
when the high school student in burke

180
00:05:42,070 --> 00:05:40,320
virginia came up with it

181
00:05:44,150 --> 00:05:42,080
that was a really cool name but it's so

182
00:05:47,110 --> 00:05:44,160
much more meaningful for all of us

183
00:05:48,870 --> 00:05:47,120
are you feeling that way i agree it

184
00:05:50,629 --> 00:05:48,880
exemplifies to me what nasa

185
00:05:52,150 --> 00:05:50,639
is all about and to me it's a huge model

186
00:05:54,150 --> 00:05:52,160
for this country we don't give up

187
00:05:56,070 --> 00:05:54,160
we keep trying and when humans really

188
00:05:58,469 --> 00:05:56,080

put their minds to it they can solve

189
00:06:00,070 --> 00:05:58,479
any problem and i think that's a really

190
00:06:00,710 --> 00:06:00,080
important message for the country right

191
00:06:02,550 --> 00:06:00,720
now

192
00:06:04,309 --> 00:06:02,560
and i love that we're recorded this in

193
00:06:06,629 --> 00:06:04,319
the environment full of history

194
00:06:08,950 --> 00:06:06,639
some of these stories are very difficult

195
00:06:11,430 --> 00:06:08,960
and some of the stories are just full of

196
00:06:13,110 --> 00:06:11,440
perseverance and i just want to tell you

197
00:06:14,629 --> 00:06:13,120
i just look forward to coming back for