

The background of the entire image is a high-resolution photograph of the Perseverance Mars rover. The rover is positioned on the left side, perched on a rocky ridge. It is facing right, with its six wheels and various scientific instruments clearly visible. The terrain is a vast, reddish-orange desert landscape with rolling dunes in the distance. The sky is a bright, hazy orange, suggesting a sunrise or sunset on Mars. The overall color palette is dominated by warm, earthy tones of red, orange, and brown.

# PERSEVERANCE MARS ROVER & THE SEARCH FOR ANCIENT LIFE



SCIENCE LIVE

VIRTUAL EDITION

1  
00:00:00,433 --> 00:00:07,474  
[ MUSIC ]

2  
00:00:07,474 --> 00:00:09,175  
>> WE ARE A SPECIES

3  
00:00:09,175 --> 00:00:11,077  
OF EXPLORERS...

4  
00:00:11,077 --> 00:00:12,112  
BELIEVERS.

5  
00:00:12,112 --> 00:00:13,079  
>> WE CHOSE TO GO TO

6  
00:00:13,079 --> 00:00:14,781  
THE MOON IN THIS DECADE

7  
00:00:14,781 --> 00:00:16,349  
AND DO THE OTHER THINGS.

8  
00:00:16,349 --> 00:00:18,184  
NOT BECAUSE THEY ARE EASY,

9  
00:00:18,184 --> 00:00:19,753  
BUT BECAUSE THEY ARE HARD.

10  
00:00:19,753 --> 00:00:20,854  
>> WE ARE WILLING TO DO

11  
00:00:20,854 --> 00:00:22,355  
THE HARD THINGS,

12  
00:00:22,355 --> 00:00:25,024  
TO OVERCOME THE MANY CHALLENGES.

13  
00:00:25,024 --> 00:00:26,292

THIS IS WHAT BRINGS OUT

14

00:00:26,292 --> 00:00:27,460

THE BEST IN US.

15

00:00:27,460 --> 00:00:28,294

>> WE ARE GO FOR

16

00:00:28,294 --> 00:00:29,562

A MISSION TO THE MOON.

17

00:00:29,562 --> 00:00:32,265

>> OUR PATH HAS LED TO SUCCESS

18

00:00:32,265 --> 00:00:33,600

AND TO BITTER LOSSES.

19

00:00:33,600 --> 00:00:34,834

>> WE COME TOGETHER TODAY

20

00:00:34,834 --> 00:00:36,102

TO MOURN THE LOSS OF

21

00:00:36,102 --> 00:00:38,405

SEVEN BRAVE AMERICANS.

22

00:00:38,405 --> 00:00:40,039

>> YET, EVEN WHEN FACED

23

00:00:40,039 --> 00:00:44,611

WITH TRAGEDY AND SETBACKS,

24

00:00:44,611 --> 00:00:46,913

WE PERSEVERE.

25

00:00:46,913 --> 00:00:48,982

WE KEEP STRIVING.

26

00:00:48,982 --> 00:00:51,918

WE KEEP BELIEVING.

27

00:00:51,918 --> 00:00:52,986

FROM SPACE,

28

00:00:52,986 --> 00:00:55,588

WE SEE OUR PLANET AS A WHOLE.

29

00:00:55,588 --> 00:00:56,689

WE SEE THE CHALLENGES

30

00:00:56,689 --> 00:00:58,658

FACING IT, AND WE FACE

31

00:00:58,658 --> 00:01:02,061

THOSE CHALLENGES TOGETHER.

32

00:01:02,061 --> 00:01:04,631

WE WILL NOT GIVE UP.

33

00:01:04,631 --> 00:01:06,633

WE CHALLENGE CONVENTION.

34

00:01:06,633 --> 00:01:07,901

WE REFUSE TO ACCEPT

35

00:01:07,901 --> 00:01:09,502

THE STATUS QUO.

36

00:01:09,502 --> 00:01:12,505

THE TIME AT HAND IS HARD,

37

00:01:12,505 --> 00:01:15,008

BUT WE WILL PERSEVERE.

38

00:01:15,008 --> 00:01:16,476

WE CAN STILL DRAW HOPE FROM

39

00:01:16,476 --> 00:01:19,012  
THE MOON AND THE STARS,

40

00:01:19,012 --> 00:01:21,915  
FROM SPACE,

41

00:01:21,915 --> 00:01:23,716  
FROM EXPLORATION.

42

00:01:23,716 --> 00:01:25,518  
THERE IS A NEW DAY BEYOND

43

00:01:25,518 --> 00:01:27,887  
THE CHALLENGES WE FACE NOW.

44

00:01:27,887 --> 00:01:29,923  
>> CURIOSITY, INSIGHT,

45

00:01:29,923 --> 00:01:32,292  
SPIRIT, OPPORTUNITY.

46

00:01:32,292 --> 00:01:33,560  
IF YOU THINK ABOUT IT,

47

00:01:33,560 --> 00:01:34,961  
ALL OF THESE NAMES OF PAST

48

00:01:34,961 --> 00:01:36,463  
MARS ROVERS ARE QUALITIES

49

00:01:36,463 --> 00:01:38,498  
WE POSSESS AS HUMANS.

50

00:01:38,498 --> 00:01:40,533  
>> TEN, NINE-- WE HAVE

51  
00:01:40,533 --> 00:01:42,168  
IGNITION SEQUENCE DIALED.

52  
00:01:42,168 --> 00:01:42,902  
>> BUT IF ROVERS START

53  
00:01:42,902 --> 00:01:43,670  
TO BE THE QUALITIES

54  
00:01:43,670 --> 00:01:45,905  
OF US AS A RACE...

55  
00:01:45,905 --> 00:01:46,706  
>> HOUSTON, WE HAVE A PROBLEM.

56  
00:01:46,706 --> 00:01:47,507  
>> WE MISS THE MOST

57  
00:01:47,507 --> 00:01:48,441  
IMPORTANT THING.

58  
00:01:48,441 --> 00:01:49,976  
>> THREE, TWO...

59  
00:01:49,976 --> 00:01:51,478  
>> PERSEVERANCE.

60  
00:01:51,478 --> 00:01:52,846  
>> LAUNCH COMMENCED.

61  
00:01:52,846 --> 00:01:53,646  
LIFTOFF!

62  
00:01:53,646 --> 00:01:56,115  
WE HAVE LIFTOFF.

63  
00:01:56,115 --> 00:01:58,551

>> WE ARE A SPECIES

64

00:01:58,551 --> 00:02:00,787  
OF EXPLORERS.

65

00:02:05,492 --> 00:02:07,827  
WE WILL MEET MANY OBSTACLES

66

00:02:07,827 --> 00:02:10,830  
ON OUR WAY TO MARS.

67

00:02:10,830 --> 00:02:12,699  
BUT AS HUMANS,

68

00:02:12,699 --> 00:02:15,735  
WE'LL NOT GIVE UP.

69

00:02:17,737 --> 00:02:20,773  
WE WILL ALWAYS PERSEVERE.

70

00:02:26,446 --> 00:02:27,514  
>> HELLO AND WELCOME TO

71

00:02:27,514 --> 00:02:28,982  
ANOTHER VIRTUAL EPISODE

72

00:02:28,982 --> 00:02:31,050  
OF NASA SCIENCE LIVE.

73

00:02:31,050 --> 00:02:32,418  
I'M RAQUEL VILLANUEVA

74

00:02:32,418 --> 00:02:33,820  
WITH NASA'S JET PROPULSION

75

00:02:33,820 --> 00:02:35,822  
LABORATORY AND TODAY WE'RE

76  
00:02:35,822 --> 00:02:37,690  
TALKING ABOUT A NEW CHAPTER

77  
00:02:37,690 --> 00:02:39,692  
OF MARS EXPLORATION.

78  
00:02:39,692 --> 00:02:40,994  
OVER THE PAST TWO DECADES,

79  
00:02:40,994 --> 00:02:43,396  
FOUR ROVERS, SOJOURNER,

80  
00:02:43,396 --> 00:02:45,131  
SPIRIT, OPPORTUNITY,

81  
00:02:45,131 --> 00:02:47,133  
AND CURIOSITY HAVE TRAVERSED

82  
00:02:47,133 --> 00:02:48,468  
THE MARTIAN LANDSCAPE

83  
00:02:48,468 --> 00:02:50,003  
REVEALING THE SECRETS OF

84  
00:02:50,003 --> 00:02:52,906  
THE RED PLANET'S ANCIENT PAST.

85  
00:02:52,906 --> 00:02:54,440  
THE CURIOSITY ROVER DISCOVERED

86  
00:02:54,440 --> 00:02:55,975  
THAT ITS LANDING SITE,

87  
00:02:55,975 --> 00:02:58,478  
GALE CRATER, HOSTED A LAKE

88  
00:02:58,478 --> 00:03:00,179

BILLIONS OF YEARS AGO

89

00:03:00,179 --> 00:03:01,114  
IN AN ENVIRONMENT THAT

90

00:03:01,114 --> 00:03:01,881  
COULD'VE SUPPORTED

91

00:03:01,881 --> 00:03:03,449  
MICROBIAL LIFE.

92

00:03:03,449 --> 00:03:04,717  
NOW PERSEVERANCE,

93

00:03:04,717 --> 00:03:06,786  
NASA'S NEXT MARS ROVER,

94

00:03:06,786 --> 00:03:08,454  
AIMS TO TAKE THE NEXT STEP

95

00:03:08,454 --> 00:03:09,355  
BY SEEKING TO ANSWER

96

00:03:09,355 --> 00:03:10,890  
ONE OF THE KEY QUESTIONS

97

00:03:10,890 --> 00:03:13,026  
OF ASTROBIOLOGY:

98

00:03:13,026 --> 00:03:14,360  
ARE THERE POTENTIAL SIGNS

99

00:03:14,360 --> 00:03:16,229  
OF PAST MICROBIAL LIFE

100

00:03:16,229 --> 00:03:18,898  
OR BIOSIGNATURES ON MARS?

101  
00:03:18,898 --> 00:03:20,700  
SO YOU MAY BE WONDERING HOW

102  
00:03:20,700 --> 00:03:22,769  
WE WILL LOOK FOR ANCIENT LIFE,

103  
00:03:22,769 --> 00:03:23,937  
WHERE WE ARE LANDING,

104  
00:03:23,937 --> 00:03:25,505  
AND WHEN WILL THIS MISSION

105  
00:03:25,505 --> 00:03:26,873  
TAKE PLACE?

106  
00:03:26,873 --> 00:03:27,840  
STAY TUNED, BECAUSE

107  
00:03:27,840 --> 00:03:29,442  
THE ANSWERS ARE COMING UP.

108  
00:03:29,442 --> 00:03:30,843  
BUT FIRST, LET'S

109  
00:03:30,843 --> 00:03:32,879  
GET TO KNOW PERSEVERANCE.

110  
00:03:33,947 --> 00:03:35,181  
>> NASA'S NEXT MARS ROVER,

111  
00:03:35,181 --> 00:03:35,982  
PERSEVERANCE,

112  
00:03:35,982 --> 00:03:38,017  
HAS AN AMBITIOUS MISSION.

113  
00:03:38,017 --> 00:03:39,385

## WE KNOW FROM DECADES OF MARS

114

00:03:39,385 --> 00:03:41,387

MISSIONS THAT THE RED PLANET

115

00:03:41,387 --> 00:03:42,522

NOT ONLY HAD WATER IN ITS

116

00:03:42,522 --> 00:03:44,591

ANCIENT PAST BUT THAT WATER

117

00:03:44,591 --> 00:03:46,459

COULD HAVE SUPPORTED LIFE.

118

00:03:46,459 --> 00:03:47,894

>> MARS IS OUR NEIGHBORING

119

00:03:47,894 --> 00:03:48,861

PLANET, AND IN MANY WAYS,

120

00:03:48,861 --> 00:03:50,396

THE MOST SIMILAR TO US

121

00:03:50,396 --> 00:03:52,231

CONCERNING ITS HISTORY.

122

00:03:52,231 --> 00:03:53,533

AND THE QUESTION WHETHER

123

00:03:53,533 --> 00:03:55,935

ANCIENT LIFE WAS THERE

124

00:03:55,935 --> 00:03:57,003

IS STILL THE QUESTION

125

00:03:57,003 --> 00:03:58,938

THAT KEEPS US UP AT NIGHT.

126  
00:03:58,938 --> 00:04:00,406  
>> IN SEARCH OF AN ANSWER,

127  
00:04:00,406 --> 00:04:01,674  
NASA IS SENDING A ROVER

128  
00:04:01,674 --> 00:04:03,076  
THE SIZE OF AN SUV TO

129  
00:04:03,076 --> 00:04:04,544  
AN ANCIENT LAKEBED ON MARS

130  
00:04:04,544 --> 00:04:06,279  
CALLED JEZERO CRATER.

131  
00:04:06,279 --> 00:04:07,246  
EQUIPPED WITH DURABLE,

132  
00:04:07,246 --> 00:04:08,548  
CUSTOM BUILT WHEELS,

133  
00:04:08,548 --> 00:04:10,016  
TWO ROBOTIC ARMS,

134  
00:04:10,016 --> 00:04:10,717  
AND A WHOLE SUITE OF

135  
00:04:10,717 --> 00:04:11,718  
SCIENCE INSTRUMENTS

136  
00:04:11,718 --> 00:04:13,386  
BOTH INSIDE AND OUT,

137  
00:04:13,386 --> 00:04:14,754  
PERSEVERANCE WILL ROVE ACROSS

138  
00:04:14,754 --> 00:04:16,022

## THE SURFACE OF MARS IN SEARCH

139

00:04:16,022 --> 00:04:17,590

OF EVIDENCE THAT ANCIENT LIFE

140

00:04:17,590 --> 00:04:19,692

MIGHT'VE EXISTED IN THE PAST.

141

00:04:19,692 --> 00:04:20,827

>> SO THE MARS 2020 ROVER

142

00:04:20,827 --> 00:04:21,894

WILL BE SEEKING SIGNS OF

143

00:04:21,894 --> 00:04:22,895

ANCIENT LIFE IN THE--

144

00:04:22,895 --> 00:04:24,464

IN THE ANCIENT ROCKS OF MARS

145

00:04:24,464 --> 00:04:25,098

TO LOOK FOR THINGS THAT

146

00:04:25,098 --> 00:04:26,399

WE CALL BIOSIGNATURES,

147

00:04:26,399 --> 00:04:27,767

WHICH ARE SIGNS THAT ANCIENT

148

00:04:27,767 --> 00:04:28,534

LIFE MIGHT'VE BEEN THERE

149

00:04:28,534 --> 00:04:29,569

IN THE PAST.

150

00:04:29,569 --> 00:04:30,303

>> BUT THAT'S NOT ALL

151  
00:04:30,303 --> 00:04:31,537  
THIS DETERMINED ROVER

152  
00:04:31,537 --> 00:04:32,839  
WILL ACCOMPLISH.

153  
00:04:32,839 --> 00:04:34,707  
>> MARS 2020 IS REALLY

154  
00:04:34,707 --> 00:04:36,042  
THE ESSENTIAL FIRST PART OF

155  
00:04:36,042 --> 00:04:37,844  
A SAMPLE RETURN MISSION,

156  
00:04:37,844 --> 00:04:39,412  
WHICH IS TO BRING SAMPLES BACK

157  
00:04:39,412 --> 00:04:41,247  
TO THE BEST LABS WE HAVE,

158  
00:04:41,247 --> 00:04:42,849  
WHICH ARE HERE ON EARTH.

159  
00:04:42,849 --> 00:04:43,850  
>> PERSEVERANCE WILL DRILL

160  
00:04:43,850 --> 00:04:44,917  
INTO MARTIAN ROCKS,

161  
00:04:44,917 --> 00:04:46,119  
COLLECT SAMPLES,

162  
00:04:46,119 --> 00:04:47,353  
AND PREPARE THEM FOR A FUTURE

163  
00:04:47,353 --> 00:04:48,721

MISSION TO PICK THEM UP

164

00:04:48,721 --> 00:04:50,590

AND BRING THEM BACK TO EARTH.

165

00:04:50,590 --> 00:04:51,257

THIS IS SOMETHING THAT'S

166

00:04:51,257 --> 00:04:52,792

NEVER BEEN DONE BEFORE.

167

00:04:52,792 --> 00:04:54,093

>> SO MARS 2020 IS THE FIRST

168

00:04:54,093 --> 00:04:56,863

HALF OF OUR RETURN TRIP.

169

00:04:56,863 --> 00:04:57,497

>> TO GET TO THE MOST

170

00:04:57,497 --> 00:04:59,332

INTERESTING ROCKS ON MARS,

171

00:04:59,332 --> 00:05:00,466

PERSEVERANCE HAS TO LAND

172

00:05:00,466 --> 00:05:01,801

SAFELY AMONG CREVICES,

173

00:05:01,801 --> 00:05:03,870

CRATERS, AND CANYONS.

174

00:05:03,870 --> 00:05:05,204

NASA ENGINEERS DESIGNED

175

00:05:05,204 --> 00:05:06,372

A NEW TERRAIN RELATIVE

176  
00:05:06,372 --> 00:05:08,307  
NAVIGATION SYSTEM,

177  
00:05:08,307 --> 00:05:09,308  
ALLOWING THE ROVER TO

178  
00:05:09,308 --> 00:05:10,643  
AUTONOMOUSLY DIVERT FROM

179  
00:05:10,643 --> 00:05:12,645  
KNOWN RISKS IN THE AREA

180  
00:05:12,645 --> 00:05:13,479  
WHILE TARGETING A SMALLER

181  
00:05:13,479 --> 00:05:15,715  
LANDING ZONE THAN EVER BEFORE.

182  
00:05:15,715 --> 00:05:16,949  
>> IT MEANS THAT WE CAN BOTH

183  
00:05:16,949 --> 00:05:18,017  
GO TO PLACES THAT ARE MAYBE

184  
00:05:18,017 --> 00:05:18,718  
MORE INTERESTING TO

185  
00:05:18,718 --> 00:05:19,752  
THE SCIENTISTS BECAUSE

186  
00:05:19,752 --> 00:05:20,887  
WE'RE ABLE TO HANDLE PLACES

187  
00:05:20,887 --> 00:05:22,789  
WITH MORE HAZARDS AS WELL AS

188  
00:05:22,789 --> 00:05:24,223

LAND CLOSER TO THE THINGS

189

00:05:24,223 --> 00:05:25,525

THAT THEY'RE INTERESTED IN

190

00:05:25,525 --> 00:05:26,325

OFF THE BAT.

191

00:05:26,325 --> 00:05:27,493

SO WE GET TO THE SCIENCE

192

00:05:27,493 --> 00:05:28,561

THAT THEY CARE ABOUT,

193

00:05:28,561 --> 00:05:29,595

AND MORE QUICKLY.

194

00:05:29,595 --> 00:05:30,329

>> SO WE CAN GET TO THE MOST

195

00:05:30,329 --> 00:05:31,464

EXCITING PLACES, WHICH ARE

196

00:05:31,464 --> 00:05:32,832

OFTEN THE MOST CHALLENGING.

197

00:05:32,832 --> 00:05:33,933

>> BUILDING ON THE DISCOVERIES

198

00:05:33,933 --> 00:05:35,134

OF ORBITERS, LANDERS,

199

00:05:35,134 --> 00:05:36,836

AND ROVERS BEFORE IT,

200

00:05:36,836 --> 00:05:38,471

PERSEVERANCE IS PIVOTAL IN OUR

201  
00:05:38,471 --> 00:05:41,107  
SEARCH FOR LIFE BEYOND EARTH.

202  
00:05:41,107 --> 00:05:42,308  
>> I COULD FINALLY ANSWER

203  
00:05:42,308 --> 00:05:44,177  
THE AGE-OLD QUESTION,

204  
00:05:44,177 --> 00:05:46,412  
ARE WE ALONE?

205  
00:05:46,412 --> 00:05:47,480  
>> TODAY, WE ARE JOINED BY

206  
00:05:47,480 --> 00:05:49,148  
PERSEVERANCE PROJECT SCIENTIST,

207  
00:05:49,148 --> 00:05:50,616  
KEN FARLEY.

208  
00:05:50,616 --> 00:05:51,284  
THANK YOU FOR JOINING US

209  
00:05:51,284 --> 00:05:52,952  
TODAY, KEN.

210  
00:05:52,952 --> 00:05:54,287  
>> YOU'RE WELCOME.

211  
00:05:54,287 --> 00:05:55,054  
>> PERSEVERANCE WILL BE

212  
00:05:55,054 --> 00:05:55,922  
SEARCHING FOR SIGNS OF

213  
00:05:55,922 --> 00:05:57,623

ANCIENT LIFE ON MARS.

214

00:05:57,623 --> 00:05:59,192

WHY IS MARS AN INTERESTING

215

00:05:59,192 --> 00:06:00,660

PLACE TO SEARCH FOR SIGNS

216

00:06:00,660 --> 00:06:03,463

OF LIFE BEYOND EARTH?

217

00:06:03,463 --> 00:06:04,564

>> RAQUEL, THE BEST PLACE

218

00:06:04,564 --> 00:06:05,798

TO LOOK FOR LIFE IS

219

00:06:05,798 --> 00:06:07,834

A PLACE WHERE YOU THINK

220

00:06:07,834 --> 00:06:09,635

LIFE COULD'VE EXISTED.

221

00:06:09,635 --> 00:06:10,937

AND MARS IS SPECIAL

222

00:06:10,937 --> 00:06:12,138

IN THIS REGARD.

223

00:06:12,138 --> 00:06:13,773

THE CURRENT SURFACE OF MARS

224

00:06:13,773 --> 00:06:15,742

IS TOO COLD AND TOO DRY

225

00:06:15,742 --> 00:06:17,043

FOR ANY LIFE THAT

226

00:06:17,043 --> 00:06:18,845  
WE KNOW ABOUT TO EXIST.

227

00:06:18,845 --> 00:06:19,912  
BUT BILLIONS OF YEARS AGO,

228

00:06:19,912 --> 00:06:21,280  
IT WAS VERY DIFFERENT.

229

00:06:21,280 --> 00:06:23,049  
IT WAS MUCH WARMER AND THERE

230

00:06:23,049 --> 00:06:24,217  
WAS WATER ON THE SURFACE.

231

00:06:24,217 --> 00:06:25,017  
THERE WERE LAKES

232

00:06:25,017 --> 00:06:26,519  
AND THERE WERE RIVERS.

233

00:06:26,519 --> 00:06:27,887  
AND ONE OF THE MOST IMPORTANT

234

00:06:27,887 --> 00:06:29,255  
THINGS THAT THE ROVER MISSIONS

235

00:06:29,255 --> 00:06:30,256  
THAT'VE GONE TO MARS OVER

236

00:06:30,256 --> 00:06:32,258  
THE LAST FEW YEARS HAVE SHOWN US

237

00:06:32,258 --> 00:06:33,226  
IS THAT THE ROCKS THAT WERE

238

00:06:33,226 --> 00:06:35,661

DEPOSITED AT THAT TIME PERIOD,

239

00:06:35,661 --> 00:06:36,929

THEY RECORD

240

00:06:36,929 --> 00:06:38,765

HABITABLE ENVIRONMENTS.

241

00:06:38,765 --> 00:06:40,266

SO THE REASON TO GO TO MARS

242

00:06:40,266 --> 00:06:42,635

IS TO LOOK AT THOSE ROCKS,

243

00:06:42,635 --> 00:06:43,402

WHICH RECORD

244

00:06:43,402 --> 00:06:44,904

HABITABLE ENVIRONMENTS,

245

00:06:44,904 --> 00:06:46,506

AND SEE IF LIFE WAS IN THEM.

246

00:06:46,506 --> 00:06:47,373

SO TO BE CLEAR,

247

00:06:47,373 --> 00:06:48,674

WE'RE NOT LOOKING FOR EXTANT

248

00:06:48,674 --> 00:06:51,043

LIFE, LIFE PRESENT TODAY.

249

00:06:51,043 --> 00:06:52,078

WE ARE LOOKING FOR LIFE

250

00:06:52,078 --> 00:06:53,546

RECORDED IN THESE ROCKS

251  
00:06:53,546 --> 00:06:54,280  
THAT WERE DEPOSITED

252  
00:06:54,280 --> 00:06:56,883  
BILLIONS OF YEARS AGO.

253  
00:06:56,883 --> 00:06:57,583  
>> WHAT DO WE THINK

254  
00:06:57,583 --> 00:06:58,985  
THIS ANCIENT LIFE

255  
00:06:58,985 --> 00:07:00,753  
MIGHT'VE LOOKED LIKE?

256  
00:07:02,955 --> 00:07:04,757  
>> WE HAVE ONLY ONE MODEL

257  
00:07:04,757 --> 00:07:07,193  
FOR WHAT LIFE HAS LOOKED LIKE

258  
00:07:07,193 --> 00:07:09,195  
OVER TIME, AND THAT'S THE EARTH.

259  
00:07:09,195 --> 00:07:11,297  
SO WE USE THAT AS A REFERENCE

260  
00:07:11,297 --> 00:07:12,231  
TO UNDERSTAND WHAT

261  
00:07:12,231 --> 00:07:13,900  
WE MIGHT FIND ON MARS.

262  
00:07:13,900 --> 00:07:15,735  
AND IF WE LOOK AT THE EARTH'S

263  
00:07:15,735 --> 00:07:16,836

ROCK RECORD FROM

264

00:07:16,836 --> 00:07:18,604  
BILLIONS OF YEARS AGO,

265

00:07:18,604 --> 00:07:19,605  
WHAT WE SEE THAT LIFE

266

00:07:19,605 --> 00:07:21,741  
AT THAT TIME, UH, IS--

267

00:07:21,741 --> 00:07:23,009  
WAS VERY PRIMITIVE.

268

00:07:23,009 --> 00:07:25,211  
IT WAS MOSTLY MICROBIAL.

269

00:07:25,211 --> 00:07:26,078  
SO WHAT THAT MEANS IS WE ARE

270

00:07:26,078 --> 00:07:27,713  
NOT LOOKING FOR FOSSILS

271

00:07:27,713 --> 00:07:29,015  
OF ADVANCED LIFE FORMS,

272

00:07:29,015 --> 00:07:29,649  
WE'RE NOT LOOKING FOR

273

00:07:29,649 --> 00:07:31,417  
DINOSAUR BONES OR FISH FOSSILS

274

00:07:31,417 --> 00:07:32,852  
OR LEAF FOSSILS.

275

00:07:32,852 --> 00:07:34,153  
WE'RE LOOKING FOR

276

00:07:34,153 --> 00:07:35,788

THE KINDS OF DEPOSITS THAT

277

00:07:35,788 --> 00:07:39,826

MICROBES WOULD LEAVE BEHIND.

278

00:07:39,826 --> 00:07:40,693

>> NOW KEN,

279

00:07:40,693 --> 00:07:41,894

I UNDERSTAND THAT MEMBERS OF

280

00:07:41,894 --> 00:07:43,296

THE PERSEVERANCE TEAM TRAVELED

281

00:07:43,296 --> 00:07:44,397

TO AUSTRALIA AS PART OF

282

00:07:44,397 --> 00:07:45,698

THE MISSION.

283

00:07:45,698 --> 00:07:46,699

COULD YOU TELL US

284

00:07:46,699 --> 00:07:47,667

WHAT THEY DID THERE

285

00:07:47,667 --> 00:07:50,903

AND WHY IT'S IMPORTANT?

286

00:07:50,903 --> 00:07:52,538

>> I WAS VERY FORTUNATE TO

287

00:07:52,538 --> 00:07:54,941

JOIN THIS-- JOIN NASA EUROPEAN

288

00:07:54,941 --> 00:07:57,109

SPACE AGENCY TRIP TO LOOK AT

289

00:07:57,109 --> 00:07:58,778

THE OLDEST UNDISPUTED

290

00:07:58,778 --> 00:08:00,913

EVIDENCE OF LIFE ON EARTH.

291

00:08:00,913 --> 00:08:02,915

IT OCCURS IN WESTERN AUSTRALIA

292

00:08:02,915 --> 00:08:05,151

IN A VERY REMOTE PLACE.

293

00:08:05,151 --> 00:08:07,119

AND WE WENT OUT TO LOOK AT THOSE

294

00:08:07,119 --> 00:08:08,821

ROCKS SO THAT WE WOULD KNOW

295

00:08:08,821 --> 00:08:11,090

WHAT MICROBIAL BIOSIGNATURES

296

00:08:11,090 --> 00:08:12,692

ACTUALLY LOOK LIKE.

297

00:08:12,692 --> 00:08:14,360

AND THE ROCKS THAT WE SAW THERE

298

00:08:14,360 --> 00:08:16,195

ARE CALLED STROMATOLITES.

299

00:08:16,195 --> 00:08:17,797

SO A STROMATOLITE IS

300

00:08:17,797 --> 00:08:19,832

PRODUCED BY MICROBES.

301  
00:08:19,832 --> 00:08:21,934  
MICROBES FORM A FILM,

302  
00:08:21,934 --> 00:08:23,703  
A LAYER, UH,

303  
00:08:23,703 --> 00:08:24,470  
AT THE BOTTOM OF

304  
00:08:24,470 --> 00:08:25,404  
A BODY OF WATER,

305  
00:08:25,404 --> 00:08:27,673  
LIKE A LAKE OR A SHALLOW SEA.

306  
00:08:27,673 --> 00:08:29,141  
AND THAT MICROBIAL FILM

307  
00:08:29,141 --> 00:08:30,643  
GROWS ON THE BOUNDARY BETWEEN

308  
00:08:30,643 --> 00:08:32,945  
THE MUD AND THE WATER.

309  
00:08:32,945 --> 00:08:33,880  
THE FILM GROWS,

310  
00:08:33,880 --> 00:08:34,881  
IT GETS BURIED.

311  
00:08:34,881 --> 00:08:35,882  
ANOTHER FILM GROWS,

312  
00:08:35,882 --> 00:08:36,983  
IT GETS BURIED.

313  
00:08:36,983 --> 00:08:38,217

SO YOU GET THIS LAYERED

314

00:08:38,217 --> 00:08:40,419

STRUCTURE THAT IS A VERY

315

00:08:40,419 --> 00:08:42,421

DISTINCTIVE PATTERN AND VERY

316

00:08:42,421 --> 00:08:43,322

DIFFERENT THAN THE KIND OF

317

00:08:43,322 --> 00:08:45,524

PATTERN THAT YOU GET IN

318

00:08:45,524 --> 00:08:46,659

ROCKS THAT ARE DEPOSITED

319

00:08:46,659 --> 00:08:48,561

IN THE ABSENCE OF LIFE.

320

00:08:48,561 --> 00:08:49,295

SO WE WENT AND LOOKED AT THESE

321

00:08:49,295 --> 00:08:50,029

ROCKS AND I HAVE TO SAY,

322

00:08:50,029 --> 00:08:51,797

I-I'M NOT AN ASTROBIOLOGIST,

323

00:08:51,797 --> 00:08:53,065

BUT I FOUND THEM

324

00:08:53,065 --> 00:08:54,166

VERY COMPELLING.

325

00:08:54,166 --> 00:08:54,867

THEY'RE THE KINDS OF THINGS

326  
00:08:54,867 --> 00:08:56,869  
YOU CAN SEE WITH YOUR EYES

327  
00:08:56,869 --> 00:08:57,637  
THAT SUGGEST THAT

328  
00:08:57,637 --> 00:08:58,905  
LIFE WAS PRESENT.

329  
00:08:58,905 --> 00:08:59,338  
AND OF COURSE,

330  
00:08:59,338 --> 00:09:00,539  
THIS WOULD BE A VERY EXCITING

331  
00:09:00,539 --> 00:09:03,276  
THING FOR US TO FIND ON MARS.

332  
00:09:03,276 --> 00:09:04,076  
>> AND CAN YOU TELL US

333  
00:09:04,076 --> 00:09:05,111  
WHAT INSTRUMENTS WILL

334  
00:09:05,111 --> 00:09:06,612  
ENABLE PERSEVERANCE TO SEARCH

335  
00:09:06,612 --> 00:09:08,381  
FOR SIGNS OF ANCIENT LIFE?

336  
00:09:08,381 --> 00:09:09,649  
HOW DO ITS INSTRUMENTS

337  
00:09:09,649 --> 00:09:13,119  
DIFFER FROM CURIOSITY?

338  
00:09:13,119 --> 00:09:14,153

>> THE PERSEVERANCE ROVER

339

00:09:14,153 --> 00:09:14,820

LOOKS A LOT LIKE

340

00:09:14,820 --> 00:09:16,522

THE CURIOSITY ROVER

341

00:09:16,522 --> 00:09:17,156

EXCEPT FOR IT HAS

342

00:09:17,156 --> 00:09:19,125

NEW SCIENCE INSTRUMENTS.

343

00:09:19,125 --> 00:09:19,892

THESE SCIENCE INSTRUMENTS

344

00:09:19,892 --> 00:09:21,360

WERE SELECTED TO ALLOW US

345

00:09:21,360 --> 00:09:23,396

TO LOOK FOR BIOSIGNATURES.

346

00:09:23,396 --> 00:09:25,164

WE WILL HAVE HIGH RESOLUTION

347

00:09:25,164 --> 00:09:27,133

CAMERAS THAT WILL ALLOW US TO

348

00:09:27,133 --> 00:09:30,069

SURVEY THE LANDSCAPE LOOKING FOR

349

00:09:30,069 --> 00:09:31,270

ROCKS THAT MIGHT'VE RECORDED

350

00:09:31,270 --> 00:09:32,905

HABITABLE ENVIRONMENTS.

351  
00:09:32,905 --> 00:09:34,240  
AND ONCE WE DRIVE UP TO THEM,

352  
00:09:34,240 --> 00:09:35,474  
WE WILL DEPLOY INSTRUMENTS

353  
00:09:35,474 --> 00:09:37,343  
THAT ARE ON THE ROBOTIC ARM.

354  
00:09:37,343 --> 00:09:39,612  
WE HAVE TWO VERY INTERESTING

355  
00:09:39,612 --> 00:09:41,714  
NEW CAPABILITIES THAT ALLOW US

356  
00:09:41,714 --> 00:09:44,317  
TO INVESTIGATE A POSTAGE STAMP

357  
00:09:44,317 --> 00:09:47,153  
SIZE AREA FOR THE ELEMENTAL

358  
00:09:47,153 --> 00:09:49,388  
COMPOSITION AND THE ORGANIC

359  
00:09:49,388 --> 00:09:51,023  
MOLECULE COMPOSITION.

360  
00:09:51,023 --> 00:09:53,225  
SO WE ESSENTIALLY MAKE A MAP

361  
00:09:53,225 --> 00:09:54,093  
AND THEN WE TAKE

362  
00:09:54,093 --> 00:09:56,595  
A MICROSCOPIC IMAGE AS WELL.

363  
00:09:56,595 --> 00:09:57,563

AND THESE THREE KINDS OF

364

00:09:57,563 --> 00:09:59,765

OBSERVATIONS, THE TEXTURE,

365

00:09:59,765 --> 00:10:01,367

THE ELEMENTAL COMPOSITION,

366

00:10:01,367 --> 00:10:02,068

AND THE DISTRIBUTION OF

367

00:10:02,068 --> 00:10:04,270

ORGANIC MOLECULES ARE A VERY

368

00:10:04,270 --> 00:10:05,838

COMPELLING WAY TO LOOK FOR

369

00:10:05,838 --> 00:10:08,641

MICROBIAL BIOSIGNATURES.

370

00:10:08,641 --> 00:10:09,809

>> AND HOW WILL PERSEVERANCE

371

00:10:09,809 --> 00:10:13,145

EXPLORE THE AREA?

372

00:10:13,145 --> 00:10:14,580

>> WE'RE VERY FORTUNATE THAT

373

00:10:14,580 --> 00:10:16,615

WE HAVE A LOT OF DETAILED

374

00:10:16,615 --> 00:10:20,252

INFORMATION ON THE LANDING SITE.

375

00:10:20,252 --> 00:10:21,654

AND ONE OF THE KEY TARGETS

376  
00:10:21,654 --> 00:10:23,222  
THAT WE CAN SEE FROM THE ORBITAL

377  
00:10:23,222 --> 00:10:25,925  
IMAGES THAT EXIST IS A DELTA.

378  
00:10:25,925 --> 00:10:27,927  
SO A DELTA IS A PLACE WHERE

379  
00:10:27,927 --> 00:10:29,829  
A RIVER FLOWED INTO A LAKE

380  
00:10:29,829 --> 00:10:30,896  
AND THE SUSPENDED SEDIMENT

381  
00:10:30,896 --> 00:10:33,299  
IN THE RIVER WAS DEPOSITED.

382  
00:10:33,299 --> 00:10:34,767  
THIS IS A VERY INTERESTING

383  
00:10:34,767 --> 00:10:36,068  
PLACE FOR US TO EXPLORE

384  
00:10:36,068 --> 00:10:37,803  
BECAUSE IT'S THE KIND OF PLACE

385  
00:10:37,803 --> 00:10:39,772  
WHERE ORGANISMS ON EARTH

386  
00:10:39,772 --> 00:10:41,273  
EXIST TODAY.

387  
00:10:41,273 --> 00:10:41,941  
AND ALSO,

388  
00:10:41,941 --> 00:10:43,642

IT'S THE KIND OF PLACE WHERE,

389

00:10:43,642 --> 00:10:45,144

BECAUSE THEY GET BURIED,

390

00:10:45,144 --> 00:10:46,112

THOSE BIOSIGNATURES ARE

391

00:10:46,112 --> 00:10:47,780

PRESERVED IN THE ROCK RECORD

392

00:10:47,780 --> 00:10:48,681

FOR US TO COME AND SEE

393

00:10:48,681 --> 00:10:50,383

BILLIONS OF YEARS LATER.

394

00:10:50,383 --> 00:10:51,250

SO ONE OF THE FIRST THINGS

395

00:10:51,250 --> 00:10:52,818

THAT WE'LL DO AFTER WE LAND IS

396

00:10:52,818 --> 00:10:53,753

WE WILL DRIVE UP AND WE WILL

397

00:10:53,753 --> 00:10:56,522

EXPLORE THAT DELTA.

398

00:10:56,522 --> 00:10:57,456

>> AND WHAT WOULD FINDING

399

00:10:57,456 --> 00:10:58,791

SIGNS OF ANCIENT LIFE MEAN

400

00:10:58,791 --> 00:11:02,461

FOR HUMANS ON EARTH?

401  
00:11:02,461 --> 00:11:02,962  
>> WELL OF COURSE,

402  
00:11:02,962 --> 00:11:04,230  
THAT IS A, UH--

403  
00:11:04,230 --> 00:11:05,598  
A CLASSIC QUESTION THAT

404  
00:11:05,598 --> 00:11:06,732  
WE ALL ASK OURSELVES.

405  
00:11:06,732 --> 00:11:08,667  
ARE-ARE WE ALONE?

406  
00:11:08,667 --> 00:11:11,337  
AND I THINK WHAT MARS 2020

407  
00:11:11,337 --> 00:11:13,472  
IS DOING IN LOOKING FOR LIFE,

408  
00:11:13,472 --> 00:11:15,274  
IF WE HAPPEN TO FIND LIFE,

409  
00:11:15,274 --> 00:11:18,077  
IT IS A VERY NON-THREATENING

410  
00:11:18,077 --> 00:11:18,878  
FORM OF LIFE.

411  
00:11:18,878 --> 00:11:20,980  
IT IS PRESUMABLY GOING TO BE

412  
00:11:20,980 --> 00:11:22,048  
MICROBIAL AND IT IS

413  
00:11:22,048 --> 00:11:23,149

GOING TO BE ANCIENT.

414

00:11:23,149 --> 00:11:24,617  
WE'RE NOT LIKELY TO FIND

415

00:11:24,617 --> 00:11:26,886  
ADVANCED ALIEN LIFE.

416

00:11:26,886 --> 00:11:27,787  
BUT THAT DOESN'T MEAN

417

00:11:27,787 --> 00:11:29,355  
IT ISN'T IMPORTANT.

418

00:11:29,355 --> 00:11:30,489  
AND IT'S IMPORTANT IN

419

00:11:30,489 --> 00:11:31,424  
THE SENSE THAT,

420

00:11:31,424 --> 00:11:32,058  
IF WE HAPPEN TO

421

00:11:32,058 --> 00:11:33,459  
FIND LIFE THERE,

422

00:11:33,459 --> 00:11:35,928  
IT WILL MEAN THAT OF THE TWO

423

00:11:35,928 --> 00:11:37,430  
ENVIRONMENTS THAT WE KNOW OF

424

00:11:37,430 --> 00:11:39,832  
ANYWHERE IN THE GALAXY,

425

00:11:39,832 --> 00:11:41,333  
THE TWO PLACES THAT WE KNOW

426  
00:11:41,333 --> 00:11:43,202  
HAVE HABITABLE ENVIRONMENTS,

427  
00:11:43,202 --> 00:11:44,637  
EARTH AND MARS,

428  
00:11:44,637 --> 00:11:46,705  
BOTH HAVE LIFE.

429  
00:11:46,705 --> 00:11:47,740  
AND THAT WOULD TEND TO SUGGEST

430  
00:11:47,740 --> 00:11:49,842  
THAT LIFE IS UBIQUITOUS.

431  
00:11:49,842 --> 00:11:50,876  
THAT WHEN YOU BUILD

432  
00:11:50,876 --> 00:11:52,478  
AN ENVIRONMENT WHERE LIFE

433  
00:11:52,478 --> 00:11:55,614  
CAN THRIVE, LIFE APPEARS.

434  
00:11:55,614 --> 00:11:57,650  
AND THEN IF YOU PUT THAT

435  
00:11:57,650 --> 00:11:59,418  
RESULT IN THE CONTEXT OF

436  
00:11:59,418 --> 00:12:00,719  
THE FACT THAT THERE ARE

437  
00:12:00,719 --> 00:12:02,455  
LITERALLY BILLIONS OF

438  
00:12:02,455 --> 00:12:05,091

PLANETS BEYOND EARTH,

439

00:12:05,091 --> 00:12:06,959

IT STARTS TO FEEL LIKELY THAT

440

00:12:06,959 --> 00:12:08,394

NOT ONLY ARE THERE HABITABLE

441

00:12:08,394 --> 00:12:09,795

PLANETS OUT THERE,

442

00:12:09,795 --> 00:12:10,963

BUT THOSE PLANETS

443

00:12:10,963 --> 00:12:12,965

MAY WELL BE INHABITED,

444

00:12:12,965 --> 00:12:15,134

THEY MAY BE INHABITED TODAY,

445

00:12:15,134 --> 00:12:17,036

AND THERE MAY ACTUALLY BE

446

00:12:17,036 --> 00:12:18,838

INTELLIGENT LIFE THERE.

447

00:12:18,838 --> 00:12:20,706

SO THAT'S ALL SPECULATION,

448

00:12:20,706 --> 00:12:21,674

BUT IT'S SPECULATION THAT

449

00:12:21,674 --> 00:12:22,908

WOULD BE INFORMED BY

450

00:12:22,908 --> 00:12:25,077

THE DISCOVERY OF LIFE

451  
00:12:25,077 --> 00:12:27,279  
ON THE ONLY HABITABLE

452  
00:12:27,279 --> 00:12:28,180  
PLACE BEYOND EARTH

453  
00:12:28,180 --> 00:12:28,948  
THAT WE KNOW ABOUT,

454  
00:12:28,948 --> 00:12:31,083  
AND THAT'S MARS.

455  
00:12:31,083 --> 00:12:31,784  
>> GREAT.

456  
00:12:31,784 --> 00:12:32,451  
THANK YOU SO MUCH FOR

457  
00:12:32,451 --> 00:12:34,653  
JOINING US TODAY, KEN.

458  
00:12:34,653 --> 00:12:35,688  
>> YOU'RE WELCOME.

459  
00:12:35,688 --> 00:12:36,655  
>> THE SEARCH FOR ANCIENT LIFE

460  
00:12:36,655 --> 00:12:39,258  
ON MARS CAN BE A DAUNTING TASK.

461  
00:12:39,258 --> 00:12:39,859  
WHERE DO YOU EVEN

462  
00:12:39,859 --> 00:12:41,060  
BEGIN TO LOOK?

463  
00:12:41,060 --> 00:12:42,094

HERE AT NASA,

464

00:12:42,094 --> 00:12:43,996

WE DEDICATED FIVE YEARS

465

00:12:43,996 --> 00:12:44,763

TO SEARCHING FOR

466

00:12:44,763 --> 00:12:46,565

THE PERFECT LANDING SITE.

467

00:12:46,565 --> 00:12:47,867

AFTER MUCH CONSIDERATION,

468

00:12:47,867 --> 00:12:50,269

NASA CHOSE JEZERO CRATER,

469

00:12:50,269 --> 00:12:53,305

A 28-MILE WIDE CRATER ONCE HOME

470

00:12:53,305 --> 00:12:55,374

TO AN ANCIENT RIVER DELTA.

471

00:12:55,374 --> 00:12:56,075

TODAY WE'RE JOINED

472

00:12:56,075 --> 00:12:57,610

BY BRIONY HORGAN,

473

00:12:57,610 --> 00:12:59,211

A SCIENCE TEAM MEMBER WORKING

474

00:12:59,211 --> 00:13:01,147

ON THE ROVER'S MASTCAM-Z

475

00:13:01,147 --> 00:13:02,615

INSTRUMENT TO TELL US MORE

476  
00:13:02,615 --> 00:13:04,717  
ABOUT THIS INTRIGUING SITE

477  
00:13:04,717 --> 00:13:07,153  
WHERE WATER ONCE FLOWED ON MARS.

478  
00:13:07,153 --> 00:13:07,953  
THANK YOU FOR JOINING US

479  
00:13:07,953 --> 00:13:09,388  
TODAY, BRIONY.

480  
00:13:09,388 --> 00:13:10,656  
>> THANKS FOR HAVING ME.

481  
00:13:10,656 --> 00:13:12,658  
>> NOW, WHY JEZERO CRATER?

482  
00:13:12,658 --> 00:13:13,993  
WHY IS THIS AN IDEAL LANDING

483  
00:13:13,993 --> 00:13:16,162  
SITE FOR THIS MISSION?

484  
00:13:16,162 --> 00:13:17,196  
>> SO JEZERO CRATER IS GOING

485  
00:13:17,196 --> 00:13:18,430  
TO BE A FANTASTIC PLACE FOR

486  
00:13:18,430 --> 00:13:20,099  
MARS 2020 BECAUSE IT'S

487  
00:13:20,099 --> 00:13:21,000  
A GREAT PLACE TO LOOK FOR

488  
00:13:21,000 --> 00:13:22,535

## SIGNS OF ANCIENT LIFE.

489

00:13:22,535 --> 00:13:23,769

WE SEE REALLY CLEAR EVIDENCE

490

00:13:23,769 --> 00:13:25,337

FROM OUR SATELLITES IN ORBIT

491

00:13:25,337 --> 00:13:26,405

THAT JEZERO CRATER ONCE

492

00:13:26,405 --> 00:13:27,873

HOSTED AN ANCIENT LAKE.

493

00:13:27,873 --> 00:13:28,974

THE BIGGEST PIECE OF EVIDENCE

494

00:13:28,974 --> 00:13:29,708

COMES FROM, YOU KNOW,

495

00:13:29,708 --> 00:13:30,476

WE JUST-- WHEN WE LOOK AT

496

00:13:30,476 --> 00:13:31,510

OUR IMAGES OF THE CRATER,

497

00:13:31,510 --> 00:13:32,778

WE SEE THIS BIG RIVER CHANNEL

498

00:13:32,778 --> 00:13:34,413

FLOWING INTO THE CRATER,

499

00:13:34,413 --> 00:13:35,281

AND THEN RIGHT WHERE IT HITS

500

00:13:35,281 --> 00:13:36,148

THE RIM OF THE CRATER,

501  
00:13:36,148 --> 00:13:37,716  
WE SEE A RIVER DELTA BEING

502  
00:13:37,716 --> 00:13:39,852  
DEPOSITED INSIDE OF JEZERO.

503  
00:13:39,852 --> 00:13:40,953  
AND SO, THAT-- THOSE, UH,

504  
00:13:40,953 --> 00:13:42,054  
DELTAS FORM WHEN YOU HAVE

505  
00:13:42,054 --> 00:13:43,556  
RIVERS FLOWING INTO LAKES

506  
00:13:43,556 --> 00:13:44,690  
AND DEPOSITING OUT ALL OF

507  
00:13:44,690 --> 00:13:45,791  
THE MUD AND OTHER SEDIMENTS

508  
00:13:45,791 --> 00:13:46,859  
THEY'RE CARRYING, AND THEY

509  
00:13:46,859 --> 00:13:48,227  
TAKE A LONG TIME TO FORM.

510  
00:13:48,227 --> 00:13:48,827  
SO WHEN WE SEE

511  
00:13:48,827 --> 00:13:50,196  
THE DELTA IN JEZERO,

512  
00:13:50,196 --> 00:13:51,330  
IT TELL US THAT THE LAKE

513  
00:13:51,330 --> 00:13:52,064

PERSISTED FOR SOME

514

00:13:52,064 --> 00:13:53,332

LONG PERIOD OF TIME.

515

00:13:53,332 --> 00:13:54,266

AND IT'S NOT EVEN JUST THAT,

516

00:13:54,266 --> 00:13:55,467

WE ACTUALLY SEE A RIVER

517

00:13:55,467 --> 00:13:56,702

CHANNEL LEADING OUT THE OTHER

518

00:13:56,702 --> 00:13:57,803

SIDE OF THE CRATER TOO,

519

00:13:57,803 --> 00:13:59,004

SO THAT TELLS US THAT

520

00:13:59,004 --> 00:14:00,072

THE RIVER FLOWED IN,

521

00:14:00,072 --> 00:14:01,006

FORMED THIS DELTA,

522

00:14:01,006 --> 00:14:01,740

AND THEN ACTUALLY FILLED

523

00:14:01,740 --> 00:14:03,175

THE CRATER UP AND OVERFLOWED

524

00:14:03,175 --> 00:14:04,577

OUT THE OTHER SIDE.

525

00:14:04,577 --> 00:14:05,477

SO THAT TELLS US THAT WE HAD

526  
00:14:05,477 --> 00:14:07,580  
A NICE LONG-LIVED, HABITABLE

527  
00:14:07,580 --> 00:14:08,314  
LAKE ENVIRONMENT WHERE

528  
00:14:08,314 --> 00:14:09,715  
LIFE COULD'VE THRIVED.

529  
00:14:09,715 --> 00:14:10,683  
AND THE DELTA ITSELF IS

530  
00:14:10,683 --> 00:14:11,984  
A GREAT PLACE TO GO LOOK FOR

531  
00:14:11,984 --> 00:14:13,085  
SIGNS OF THAT ANCIENT LIFE

532  
00:14:13,085 --> 00:14:14,119  
BECAUSE WE THINK THE BOTTOM OF

533  
00:14:14,119 --> 00:14:15,487  
THE DELTA PRESERVES

534  
00:14:15,487 --> 00:14:16,322  
THE BOTTOM OF THE LAKE.

535  
00:14:16,322 --> 00:14:17,590  
SO ALL THE MUDS AND THINGS

536  
00:14:17,590 --> 00:14:19,158  
THAT ACCUMULATED ALL THE STUFF

537  
00:14:19,158 --> 00:14:20,526  
THAT FELL OUT OF THE LAKE.

538  
00:14:20,526 --> 00:14:21,093

UH, THINGS LIKE

539

00:14:21,093 --> 00:14:22,094  
ORGANIC MATERIALS THAT

540

00:14:22,094 --> 00:14:22,962  
COULD'VE BEEN, YOU KNOW,

541

00:14:22,962 --> 00:14:23,729  
INCORPORATED INTO

542

00:14:23,729 --> 00:14:24,530  
THE LIFE THERE,

543

00:14:24,530 --> 00:14:26,031  
OTHER SIGNS OF ANCIENT LIFE,

544

00:14:26,031 --> 00:14:26,999  
OTHER, UM, YOU KNOW,

545

00:14:26,999 --> 00:14:28,000  
FOSSILIZED BITS OF LIFE,

546

00:14:28,000 --> 00:14:29,101  
THINGS LIKE THAT COULD BE

547

00:14:29,101 --> 00:14:29,802  
PRESERVED IN THE BOTTOM

548

00:14:29,802 --> 00:14:31,403  
OF THE DELTA.

549

00:14:31,403 --> 00:14:32,805  
BUT IT'S NOT JUST THE DELTA

550

00:14:32,805 --> 00:14:33,739  
AND SORT OF THOSE FEATURES

551  
00:14:33,739 --> 00:14:34,807  
THAT WE SEE IN THE IMAGES

552  
00:14:34,807 --> 00:14:35,641  
THAT ARE REALLY INTERESTING,

553  
00:14:35,641 --> 00:14:36,675  
WE ALSO SEE EVIDENCE FOR

554  
00:14:36,675 --> 00:14:38,010  
INTERESTING MINERALS THAT

555  
00:14:38,010 --> 00:14:39,211  
MIGHT'VE FORMED IN THIS LAKE.

556  
00:14:39,211 --> 00:14:39,778  
IN PARTICULAR,

557  
00:14:39,778 --> 00:14:41,413  
WE SEE A RING OF CARBONATE

558  
00:14:41,413 --> 00:14:42,615  
MINERALS RIGHT AROUND

559  
00:14:42,615 --> 00:14:44,216  
THE INSIDE MARGIN OF THE CRATER,

560  
00:14:44,216 --> 00:14:44,917  
AND CARBONATES ARE REALLY

561  
00:14:44,917 --> 00:14:46,552  
INTERESTING BECAUSE ON EARTH,

562  
00:14:46,552 --> 00:14:47,653  
THEY FORM IN LAKES

563  
00:14:47,653 --> 00:14:48,687

AND OCEANS WHEN YOU HAVE

564

00:14:48,687 --> 00:14:50,089

A LITTLE BIT OF EVAPORATION

565

00:14:50,089 --> 00:14:50,990

AND THEY PRECIPITATE OUT

566

00:14:50,990 --> 00:14:52,191

NEAR THE SHORELINES.

567

00:14:52,191 --> 00:14:53,025

AND WE SEE THIS RING

568

00:14:53,025 --> 00:14:54,059

OF CARBONATE IN JEZERO

569

00:14:54,059 --> 00:14:55,261

RIGHT WHERE WE EXPECT ANCIENT

570

00:14:55,261 --> 00:14:56,495

SHORELINES TO HAVE BEEN.

571

00:14:56,495 --> 00:14:57,229

SO WE THINK IT MIGHT BE

572

00:14:57,229 --> 00:14:57,863

TELLING US SOMETHING

573

00:14:57,863 --> 00:14:58,931

ABOUT THE LAKE.

574

00:14:58,931 --> 00:15:00,332

THIS IS ALSO GREAT FOR LOOKING

575

00:15:00,332 --> 00:15:01,133

FOR SIGNS OF ANCIENT LIFE,

576  
00:15:01,133 --> 00:15:02,401  
THOUGH, BECAUSE CARBONATES,

577  
00:15:02,401 --> 00:15:03,936  
WHERE THEY FORM ON EARTH,

578  
00:15:03,936 --> 00:15:05,004  
THEY CAN ACTUALLY PRECIPITATE

579  
00:15:05,004 --> 00:15:06,405  
OUT AND TRAP ANYTHING

580  
00:15:06,405 --> 00:15:07,273  
THAT'S LIVING RIGHT

581  
00:15:07,273 --> 00:15:08,641  
ALONG THEIR SHORELINES.

582  
00:15:08,641 --> 00:15:09,675  
WE SEE THIS REALLY COMMONLY

583  
00:15:09,675 --> 00:15:11,277  
WITH THINGS LIKE MICROBIAL MATS

584  
00:15:11,277 --> 00:15:12,244  
THAT GROW ALONG THE SHORELINES

585  
00:15:12,244 --> 00:15:13,512  
OF LAKES ON EARTH.

586  
00:15:13,512 --> 00:15:14,480  
UH, AND THEN THE CARBONATE

587  
00:15:14,480 --> 00:15:15,581  
PRECIPITATES OUT AND CAN

588  
00:15:15,581 --> 00:15:16,782

ACTUALLY FOSSILIZE THEM

589

00:15:16,782 --> 00:15:17,816  
IN THAT WAY AND KIND OF

590

00:15:17,816 --> 00:15:19,351  
PRESERVE THEM IN A ROCK RECORD.

591

00:15:19,351 --> 00:15:20,486  
SO MARS 2020 IS GOING TO

592

00:15:20,486 --> 00:15:21,987  
EXPLORE BOTH THE DELTA

593

00:15:21,987 --> 00:15:22,888  
AND THE SHORELINES OF

594

00:15:22,888 --> 00:15:23,989  
ANCIENT LAKE JEZERO TO

595

00:15:23,989 --> 00:15:25,858  
LOOK FOR SIGNS OF LIFE.

596

00:15:25,858 --> 00:15:27,026  
>> YOU KIND OF TOUCHED ON THIS,

597

00:15:27,026 --> 00:15:28,661  
BUT WHAT DID JEZERO CRATER

598

00:15:28,661 --> 00:15:30,963  
ONCE LOOK LIKE?

599

00:15:30,963 --> 00:15:31,430  
>> SO, IT WOULD'VE BEEN

600

00:15:31,430 --> 00:15:32,398  
A PRETTY BIG LAKE.

601

00:15:32,398 --> 00:15:33,565

I MEAN, SO, IT'S ABOUT H--

602

00:15:33,565 --> 00:15:34,133

IT WOULD'VE BEEN ABOUT HALF

603

00:15:34,133 --> 00:15:35,367

THE SIZE OF LAKE ONTARIO

604

00:15:35,367 --> 00:15:36,168

AND ALMOST AS DEEP,

605

00:15:36,168 --> 00:15:37,703

A COUPLE HUNDRED METERS DEEP,

606

00:15:37,703 --> 00:15:38,904

AND, UH, WE ALSO THINK

607

00:15:38,904 --> 00:15:40,506

IT WAS A PRETTY OLD LAKE,

608

00:15:40,506 --> 00:15:41,106

SO WE THINK IT MIGHT'VE

609

00:15:41,106 --> 00:15:42,775

FORMED ON MARS ABOUT, UH,

610

00:15:42,775 --> 00:15:45,244

AS OLD AS 3.8 BILLION YEARS AGO.

611

00:15:45,244 --> 00:15:45,744

AND THAT TIMING'S

612

00:15:45,744 --> 00:15:46,412

REALLY IMPORTANT,

613

00:15:46,412 --> 00:15:47,079

'CAUSE THAT'S RIGHT WHEN WE

614

00:15:47,079 --> 00:15:48,414

THINK LIFE WAS REALLY GETTING

615

00:15:48,414 --> 00:15:49,982

STARTED HERE ON EARTH,

616

00:15:49,982 --> 00:15:50,716

SO THAT MEANS WE HAVE

617

00:15:50,716 --> 00:15:51,884

A HABITABLE ENVIRONMENT

618

00:15:51,884 --> 00:15:52,985

ON MARS THAT WAS THERE

619

00:15:52,985 --> 00:15:54,486

FOR A LONG PERIOD OF TIME,

620

00:15:54,486 --> 00:15:55,888

THAT WAS THERE WHEN LIFE

621

00:15:55,888 --> 00:15:57,056

WAS HOPEFULLY, UH,

622

00:15:57,056 --> 00:15:58,457

SPREADING ACROSS THE PLANET.

623

00:15:58,457 --> 00:15:59,191

SO WE HOPE IT'LL PRESERVE

624

00:15:59,191 --> 00:16:01,026

SIGNS OF THAT LIFE.

625

00:16:01,026 --> 00:16:01,627

>> AND SPEAKING OF LIFE,

626  
00:16:01,627 --> 00:16:02,861  
I UNDERSTAND THAT WE'RE ALSO

627  
00:16:02,861 --> 00:16:03,962  
COLLECTING SAMPLES AT

628  
00:16:03,962 --> 00:16:05,197  
JEZERO CRATER FOR FUTURE

629  
00:16:05,197 --> 00:16:07,066  
MISSIONS TO RETURN TO EARTH.

630  
00:16:07,066 --> 00:16:08,300  
AND WHY ARE WE DOING THAT

631  
00:16:08,300 --> 00:16:10,736  
AND WHAT DO WE HOPE TO FIND?

632  
00:16:10,736 --> 00:16:11,170  
>> YEAH, WELL,

633  
00:16:11,170 --> 00:16:11,870  
THAT'S A GREAT QUESTION.

634  
00:16:11,870 --> 00:16:13,339  
SO, YOU KNOW, WITH MARS 2020,

635  
00:16:13,339 --> 00:16:14,807  
WE'RE HOPING TO SEE SIGNS

636  
00:16:14,807 --> 00:16:15,774  
OF ANCIENT LIFE WITH

637  
00:16:15,774 --> 00:16:16,675  
THE ROVER ITSELF.

638  
00:16:16,675 --> 00:16:17,409

## WHEN WE'RE DOING

639

00:16:17,409 --> 00:16:18,077

THE BEST WE CAN.

640

00:16:18,077 --> 00:16:19,044

WE HAVE GREAT INSTRUMENTS

641

00:16:19,044 --> 00:16:19,611

THAT CAN HELP US

642

00:16:19,611 --> 00:16:21,280

IDENTIFY ORGANIC MATERIALS

643

00:16:21,280 --> 00:16:22,715

ASSOCIATED WITH THE LIFE,

644

00:16:22,715 --> 00:16:24,149

HELP LOOK FOR TEXTURES DUE TO

645

00:16:24,149 --> 00:16:25,584

THINGS LIKE MICROBIAL MATS

646

00:16:25,584 --> 00:16:26,418

GROWING ON THE SHORES

647

00:16:26,418 --> 00:16:27,519

OF THIS ANCIENT LAKE.

648

00:16:27,519 --> 00:16:28,654

BUT ULTIMATELY, YOU KNOW,

649

00:16:28,654 --> 00:16:29,755

IT'S A REALLY HARD THING TO DO,

650

00:16:29,755 --> 00:16:30,489

TO LOOK FOR SIGNS OF

651  
00:16:30,489 --> 00:16:31,924  
ANCIENT MICROBIAL LIFE.

652  
00:16:31,924 --> 00:16:33,425  
IT'S JUST REALLY SMALL.

653  
00:16:33,425 --> 00:16:34,193  
AND SO EVEN ON EARTH,

654  
00:16:34,193 --> 00:16:34,960  
WHEN WE LOOK FOR SIGNS OF

655  
00:16:34,960 --> 00:16:36,161  
ANCIENT MICROBIAL LIFE

656  
00:16:36,161 --> 00:16:37,596  
IN THE EARTH'S ROCK RECORD,

657  
00:16:37,596 --> 00:16:39,131  
WE REALLY HAVE TO USE THINGS

658  
00:16:39,131 --> 00:16:40,666  
LIKE ELECTRON MICROSCOPES,

659  
00:16:40,666 --> 00:16:42,067  
YOU KNOW, REALLY HEAVY-DUTY,

660  
00:16:42,067 --> 00:16:43,602  
HIGHER-RESOLUTION LABORATORY

661  
00:16:43,602 --> 00:16:44,436  
INSTRUMENTS THAT WE JUST,

662  
00:16:44,436 --> 00:16:45,971  
UH, CAN'T-- AT LEAST YET--

663  
00:16:45,971 --> 00:16:46,705

CAN'T SEND TO MARS

664

00:16:46,705 --> 00:16:48,040  
ON THE BACK OF A ROVER.

665

00:16:48,040 --> 00:16:50,008  
SO TO REALLY BE SURE THAT WE'RE

666

00:16:50,008 --> 00:16:51,477  
SEEING SIGNS OF ANCIENT LIFE

667

00:16:51,477 --> 00:16:52,678  
ON MARS IN THE ROCKS THERE,

668

00:16:52,678 --> 00:16:53,679  
WE HAVE TO BRING SAMPLES

669

00:16:53,679 --> 00:16:55,013  
BACK EARTH TO CHECK.

670

00:16:55,013 --> 00:16:55,981  
WE'RE ALSO HOPING WE'LL GET ALL

671

00:16:55,981 --> 00:16:57,416  
KINDS OF GREAT OTHER SAMPLES

672

00:16:57,416 --> 00:16:58,550  
TELLING US ABOUT THE HISTORY

673

00:16:58,550 --> 00:16:59,852  
OF MARS, UH, YOU KNOW,

674

00:16:59,852 --> 00:17:01,019  
FOR EXAMPLE, SOME OF THE SAMPLES

675

00:17:01,019 --> 00:17:02,254  
MIGHT HELP US DATE WHEN

676  
00:17:02,254 --> 00:17:03,555  
A LOT OF THESE THINGS HAPPEN,

677  
00:17:03,555 --> 00:17:05,190  
SO WHEN WAS THE LAKE THERE?

678  
00:17:05,190 --> 00:17:05,824  
THAT'S ALSO A REALLY

679  
00:17:05,824 --> 00:17:06,859  
HARD QUESTION TO ANSWER

680  
00:17:06,859 --> 00:17:07,726  
WITH THE ROVER, BUT WE CAN

681  
00:17:07,726 --> 00:17:08,494  
DO THAT WHEN WE BRING

682  
00:17:08,494 --> 00:17:10,095  
THE SAMPLES BACK TO EARTH.

683  
00:17:10,095 --> 00:17:11,096  
>> WOW, AND THANK YOU FOR

684  
00:17:11,096 --> 00:17:12,398  
ANSWERING MY QUESTIONS.

685  
00:17:12,398 --> 00:17:13,565  
NOW LET'S TAKE A QUESTION

686  
00:17:13,565 --> 00:17:14,833  
FROM THE SOCIAL MEDIA

687  
00:17:14,833 --> 00:17:17,069  
HASHTAG #askNASA.

688  
00:17:17,069 --> 00:17:18,971

SOMOIT ON FACEBOOK ASKS,

689

00:17:18,971 --> 00:17:20,272

"A TEAM OF RESEARCHERS

690

00:17:20,272 --> 00:17:20,939

FROM THE EUROPEAN

691

00:17:20,939 --> 00:17:22,574

SPACE AGENCY RECENTLY

692

00:17:22,574 --> 00:17:23,575

PUBLISHED SOME INTERESTING

693

00:17:23,575 --> 00:17:24,810

FINDINGS ABOUT MUD ON

694

00:17:24,810 --> 00:17:26,111

THE SURFACE OF MARS THAT

695

00:17:26,111 --> 00:17:28,680

FLOWS LIKE LAVA ON EARTH.

696

00:17:28,680 --> 00:17:29,681

NOW, WILL YOU BE

697

00:17:29,681 --> 00:17:32,050

LOOKING INTO THIS TOO?"

698

00:17:32,050 --> 00:17:32,718

>> FOR SURE, THAT'S

699

00:17:32,718 --> 00:17:34,186

DEFINITELY AN INTERESTING IDEA.

700

00:17:34,186 --> 00:17:35,087

I MEAN, SO ACTUALLY,

701  
00:17:35,087 --> 00:17:36,989  
THE THING-- THE-THE DEPOSIT

702  
00:17:36,989 --> 00:17:37,956  
WE THINK WE'RE GOING TO LAND

703  
00:17:37,956 --> 00:17:39,024  
ON A JEZERO CRATER ISN'T

704  
00:17:39,024 --> 00:17:39,992  
NECESSARILY THE LAKE

705  
00:17:39,992 --> 00:17:41,393  
SEDIMENTS THEMSELVES.

706  
00:17:41,393 --> 00:17:42,161  
IT ACTUALLY MIGHT BE

707  
00:17:42,161 --> 00:17:44,062  
THIS KIND OF DARK, UH, UNIT

708  
00:17:44,062 --> 00:17:45,197  
THAT'S RIGHT AT THE SURFACE.

709  
00:17:45,197 --> 00:17:45,898  
IT KINDA LOOKS LIKE

710  
00:17:45,898 --> 00:17:46,765  
A LAVA FLOW.

711  
00:17:46,765 --> 00:17:48,367  
IT HAS THESE EDGES THAT LOOK

712  
00:17:48,367 --> 00:17:49,101  
LIKE THEY FLOWED AROUND

713  
00:17:49,101 --> 00:17:50,536

HIGH POINTS IN THE CRATER,

714

00:17:50,536 --> 00:17:51,603

AND IT'S REALLY DARK.

715

00:17:51,603 --> 00:17:52,604

UM, BUT IT ALSO COULD BE

716

00:17:52,604 --> 00:17:53,739

SOMETHING LIKE A MUD FLOW,

717

00:17:53,739 --> 00:17:54,273

WHEN WE'RE THINKING

718

00:17:54,273 --> 00:17:55,474

ABOUT IDEAS LIKE THAT.

719

00:17:55,474 --> 00:17:56,141

SO, YOU KNOW, WE'RE NOT--

720

00:17:56,141 --> 00:17:56,975

WE'RE NOT TOTALLY SURE

721

00:17:56,975 --> 00:17:57,709

JUST BASED ON WE SEE

722

00:17:57,709 --> 00:17:59,077

FROM ORBIT WHAT IT IS.

723

00:17:59,077 --> 00:17:59,578

WE'LL BE THINKING ABOUT

724

00:17:59,578 --> 00:18:00,345

MUD FLOWS,

725

00:18:00,345 --> 00:18:01,046

WE'LL BE THINKING ABOUT,

726

00:18:01,046 --> 00:18:01,914

YOU KNOW, COULD IT BE

727

00:18:01,914 --> 00:18:02,981

LATER LAKE SEDIMENTS THAT

728

00:18:02,981 --> 00:18:04,550

CAME IN AND WERE LAID DOWN?

729

00:18:04,550 --> 00:18:05,184

SO HOPEFULLY IT'S ONE OF

730

00:18:05,184 --> 00:18:05,751

THE FIRST THINGS WE'LL

731

00:18:05,751 --> 00:18:06,518

FIGURE OUT WHEN WE GET

732

00:18:06,518 --> 00:18:08,720

INTO JEZERO CRATER.

733

00:18:08,720 --> 00:18:09,221

>> THANK YOU.

734

00:18:09,221 --> 00:18:09,855

THANKS FOR ANSWERING

735

00:18:09,855 --> 00:18:10,656

MY QUESTIONS, BRIONY.

736

00:18:10,656 --> 00:18:12,558

NOW PERSEVERANCE IS PLANNING

737

00:18:12,558 --> 00:18:13,625

TO GO TO JEZERO CRATER

738

00:18:13,625 --> 00:18:15,461

ON MARS TO COLLECT SAMPLES

739

00:18:15,461 --> 00:18:16,328  
SO THAT ONE DAY WE CAN

740

00:18:16,328 --> 00:18:17,362  
SEND THOSE SAMPLES BACK

741

00:18:17,362 --> 00:18:18,697  
TO EARTH TO DETERMINE IF

742

00:18:18,697 --> 00:18:20,532  
THERE WAS EVER LIFE ON MARS.

743

00:18:20,532 --> 00:18:21,667  
BUT HOW DO WE MAKE SURE THAT

744

00:18:21,667 --> 00:18:23,435  
THE LIFE WE FIND ON MARS ISN'T

745

00:18:23,435 --> 00:18:24,636  
SOMETHING WE'VE BROUGHT BACK

746

00:18:24,636 --> 00:18:26,505  
FROM US FROM EARTH?

747

00:18:26,505 --> 00:18:27,773  
PLANETARY PROTECTION OFFICERS

748

00:18:27,773 --> 00:18:29,308  
AT NASA ACTIVELY TEST

749

00:18:29,308 --> 00:18:30,943  
ALL SPACECRAFT FOR

750

00:18:30,943 --> 00:18:31,977  
MICROBIAL STOWAWAYS

751  
00:18:31,977 --> 00:18:34,213  
BEFORE THEY LEAVE OUR PLANET.

752  
00:18:34,213 --> 00:18:36,248  
LET'S FOLLOW MOOGEA STRICKER

753  
00:18:36,248 --> 00:18:37,249  
AS SHE TAKES US BEHIND

754  
00:18:37,249 --> 00:18:38,650  
THE SCENES AT NASA'S

755  
00:18:38,650 --> 00:18:39,985  
KENNEDY SPACE CENTER

756  
00:18:39,985 --> 00:18:41,920  
TO SEE HOW IT'S DONE.

757  
00:18:41,920 --> 00:18:42,588  
>> HI, MY NAME IS

758  
00:18:42,588 --> 00:18:43,455  
MOOGEA STRICKER,

759  
00:18:43,455 --> 00:18:44,089  
AND I'M THE PLANETARY

760  
00:18:44,089 --> 00:18:44,990  
PROTECTION LEAD FOR

761  
00:18:44,990 --> 00:18:46,725  
THE MARS 2020 MISSION OUT AT

762  
00:18:46,725 --> 00:18:48,927  
THE JET PROPULSION LABORATORY.

763  
00:18:48,927 --> 00:18:50,362

I'M ACTUALLY TALKING TO YOU

764

00:18:50,362 --> 00:18:51,697  
FROM THE KENNEDY SPACE CENTER

765

00:18:51,697 --> 00:18:53,298  
IN CAPE CANAVERAL, FLORIDA,

766

00:18:53,298 --> 00:18:54,700  
BECAUSE WE TOOK OUR LAB,

767

00:18:54,700 --> 00:18:55,367  
WE PICKED IT UP,

768

00:18:55,367 --> 00:18:57,169  
WE MOVED IT ACROSS COUNTRY,

769

00:18:57,169 --> 00:18:57,936  
SO THAT WE CAN FOLLOW

770

00:18:57,936 --> 00:18:59,338  
THE SPACECRAFT WHILE IT GOES

771

00:18:59,338 --> 00:18:59,905  
THROUGH ITS FINAL

772

00:18:59,905 --> 00:19:01,507  
ASSEMBLY AND TESTING,

773

00:19:01,507 --> 00:19:03,809  
ALL THE WAY THROUGH LAUNCH.

774

00:19:03,809 --> 00:19:04,977  
WE TAKE SEVERAL SAMPLES

775

00:19:04,977 --> 00:19:06,111  
OF THE SPACECRAFT

776

00:19:06,111 --> 00:19:06,778

AND WE PROCESS IT

777

00:19:06,778 --> 00:19:08,814

IN THIS VERY LAB.

778

00:19:08,814 --> 00:19:10,415

WE TAKE EITHER SWABS

779

00:19:10,415 --> 00:19:12,518

OR WIPES OF THE SURFACE,

780

00:19:12,518 --> 00:19:13,252

AND ONE OF THE FIRST THINGS

781

00:19:13,252 --> 00:19:15,587

THAT WE DO IS WE SONICATE IT.

782

00:19:15,587 --> 00:19:17,022

SONICATION IS HITTING IT WITH

783

00:19:17,022 --> 00:19:19,358

SOUNDWAVES SO THAT IT CAN

784

00:19:19,358 --> 00:19:21,093

GENTLY RELEASE THE MICROBES

785

00:19:21,093 --> 00:19:22,427

FROM THE SURFACE OF THE SAMPLING

786

00:19:22,427 --> 00:19:24,429

TOOL WITHOUT DAMAGING IT,

787

00:19:24,429 --> 00:19:25,364

'CAUSE WE WANNA GROW IT UP

788

00:19:25,364 --> 00:19:26,498

AND SEE WHAT EXISTS

789

00:19:26,498 --> 00:19:28,500  
ON THE SPACECRAFT.

790

00:19:28,500 --> 00:19:29,301  
SO THEY SONICATE IT,

791

00:19:29,301 --> 00:19:31,169  
WE RELEASE THOSE MICROBES,

792

00:19:31,169 --> 00:19:32,704  
THEN WE HEAT SHOCK IT.

793

00:19:32,704 --> 00:19:33,939  
HEAT SHOCKING, UH,

794

00:19:33,939 --> 00:19:35,507  
AT 80 DEGREES CELSIUS,

795

00:19:35,507 --> 00:19:37,075  
OR 167 DEGREE--

796

00:19:37,075 --> 00:19:39,444  
176 DEGREES, FAHRENHEIT,

797

00:19:39,444 --> 00:19:42,047  
UH, BASICALLY ALLOWS US TO

798

00:19:42,047 --> 00:19:43,815  
ELIMINATE THE COMMON MICROBES

799

00:19:43,815 --> 00:19:45,784  
LIKE STAPH AND E. COLI,

800

00:19:45,784 --> 00:19:46,919  
THINGS THAT EXIST,

801  
00:19:46,919 --> 00:19:47,853  
UH, ON HUMANS OR

802  
00:19:47,853 --> 00:19:49,187  
IN THE ENVIRONMENT.

803  
00:19:49,187 --> 00:19:50,656  
BUT WE CAN SELECT FOR

804  
00:19:50,656 --> 00:19:52,491  
REALLY HARDY SPORES.

805  
00:19:52,491 --> 00:19:54,459  
THESE SPORES HAVE THE ABILITY

806  
00:19:54,459 --> 00:19:57,129  
TO SURVIVE DESICCATION,

807  
00:19:57,129 --> 00:19:58,597  
THE VACUUM OF SPACE,

808  
00:19:58,597 --> 00:20:00,165  
HIGHER TEMPERATURES,

809  
00:20:00,165 --> 00:20:02,334  
AND IT'S THE MAIN FORM OF LIFE

810  
00:20:02,334 --> 00:20:04,336  
THAT HAS THE HIGHEST POTENTIAL

811  
00:20:04,336 --> 00:20:06,572  
TO SURVIVE THE JOURNEY TO MARS.

812  
00:20:06,572 --> 00:20:07,906  
SO WE PERFORM

813  
00:20:07,906 --> 00:20:09,408

PLANETARY PROTECTION,

814

00:20:09,408 --> 00:20:10,609

THE REASON WHY WE SELECT FOR

815

00:20:10,609 --> 00:20:12,311

SPORES IS BECAUSE THE GOAL OF

816

00:20:12,311 --> 00:20:13,845

FORWARD PLANETARY PROTECTION

817

00:20:13,845 --> 00:20:15,213

IS TO MAKE SURE

818

00:20:15,213 --> 00:20:16,214

WE DON'T CONTAMINATE

819

00:20:16,214 --> 00:20:17,149

THE ENVIRONMENT THAT WE'RE

820

00:20:17,149 --> 00:20:19,084

EXPLORING SO THAT WE'RE

821

00:20:19,084 --> 00:20:20,452

RESPONSIBLE CITIZENS,

822

00:20:20,452 --> 00:20:22,154

AND, UH, WE BASICALLY

823

00:20:22,154 --> 00:20:23,055

DO THE RIGHT THING.

824

00:20:23,055 --> 00:20:24,856

IT'S THE RIGHT THING TO DO.

825

00:20:24,856 --> 00:20:26,158

IN ADDITION TO THAT,

826  
00:20:26,158 --> 00:20:27,726  
A SEPARATE THING THAT INVOLVES

827  
00:20:27,726 --> 00:20:29,695  
A LOT OF BIOLOGY IS CALLED

828  
00:20:29,695 --> 00:20:31,396  
RETURN SAMPLE SCIENCE.

829  
00:20:31,396 --> 00:20:32,764  
SO THAT'S A SEPARATE ENTITY

830  
00:20:32,764 --> 00:20:34,433  
THAT ALLOWS US TO NOT ONLY

831  
00:20:34,433 --> 00:20:36,368  
LOOK FOR THE SPORE FORMERS,

832  
00:20:36,368 --> 00:20:38,437  
BUT ALSO TAKE SAMPLES AND LOOK

833  
00:20:38,437 --> 00:20:40,472  
FOR DNA OR LOOK FOR ALL

834  
00:20:40,472 --> 00:20:42,441  
NON-SPORE FORMERS AND MAKE

835  
00:20:42,441 --> 00:20:43,642  
SURE THAT THEY DON'T WORK

836  
00:20:43,642 --> 00:20:45,911  
ITS WAY TO THE ACQUIRED SAMPLE

837  
00:20:45,911 --> 00:20:47,179  
SO THAT WE CAN DO GOOD SCIENCE

838  
00:20:47,179 --> 00:20:48,480

AND CONFIDENTLY SAY THAT

839

00:20:48,480 --> 00:20:50,015  
THE SIGNAL THAT WE SEE

840

00:20:50,015 --> 00:20:51,850  
IS A TRUE SIGNAL.

841

00:20:51,850 --> 00:20:53,385  
SO WE DO ALL THAT IN THIS

842

00:20:53,385 --> 00:20:55,587  
LABORATORY HERE THAT-THAT

843

00:20:55,587 --> 00:20:56,588  
YOU'RE SEEING RIGHT NOW.

844

00:20:56,588 --> 00:20:58,090  
THESE ARE PETRI DISHES

845

00:20:58,090 --> 00:21:00,359  
THAT ARE-- THEY LOOK BLANK,

846

00:21:00,359 --> 00:21:01,026  
BUT THEY ACTUALLY HAVE

847

00:21:01,026 --> 00:21:02,594  
REAL SAMPLES IN HERE.

848

00:21:02,594 --> 00:21:03,562  
AND IT'S SO CLEAN THAT

849

00:21:03,562 --> 00:21:04,763  
WE DON'T ACTUALLY DETECT

850

00:21:04,763 --> 00:21:06,264  
MICROBES ON THE SURFACE,

851  
00:21:06,264 --> 00:21:07,232  
SO WE HAVE TO WAIT THREE DAYS

852  
00:21:07,232 --> 00:21:08,734  
FOR THEM TO GROW, UM,

853  
00:21:08,734 --> 00:21:09,534  
TO A LEVEL THAT WE CAN

854  
00:21:09,534 --> 00:21:11,937  
SEE THEM BY EYE.

855  
00:21:11,937 --> 00:21:13,872  
WE ALSO, WHEN WE LOOK FOR DNA,

856  
00:21:13,872 --> 00:21:14,873  
CATCH EVERYTHING,

857  
00:21:14,873 --> 00:21:16,541  
ALL FORMS OF MICROBIOLOGY,

858  
00:21:16,541 --> 00:21:18,110  
UH, INCLUDING VIRUSES.

859  
00:21:18,110 --> 00:21:19,711  
AND ONE OF MY NUMBER ONE

860  
00:21:19,711 --> 00:21:20,879  
QUESTIONS THAT I GET

861  
00:21:20,879 --> 00:21:22,814  
THESE DAYS IS HAVE-HAVE YOU

862  
00:21:22,814 --> 00:21:23,915  
DONE ANYTHING DIFFERENTLY

863  
00:21:23,915 --> 00:21:25,017

SINCE CORONAVIRUS CAME,

864

00:21:25,017 --> 00:21:26,485

AND MY ANSWER IS NO,

865

00:21:26,485 --> 00:21:27,819

BECAUSE EVERYTHING THAT WE DO,

866

00:21:27,819 --> 00:21:29,321

THE SAMPLES THAT WE COLLECT,

867

00:21:29,321 --> 00:21:30,822

WILL EITHER, UH,

868

00:21:30,822 --> 00:21:32,190

DETECT CORONAVIRUS

869

00:21:32,190 --> 00:21:34,926

OR WILL KILL CORONAVIRUS

870

00:21:34,926 --> 00:21:36,495

AMONG ALL THE OTHER,

871

00:21:36,495 --> 00:21:38,463

EVEN HARDIER MICROORGANISMS

872

00:21:38,463 --> 00:21:40,232

THAT WE'RE ACTUALLY LOOKING FOR.

873

00:21:40,232 --> 00:21:42,267

SO CORONAVIRUS IS SOMETHING

874

00:21:42,267 --> 00:21:44,002

THAT WE ARE-- THAT'S ON

875

00:21:44,002 --> 00:21:45,337

OUR RADAR FOR DETECTION,

876  
00:21:45,337 --> 00:21:48,407  
BUT IT'S DEFINITELY NOT WHAT--

877  
00:21:48,407 --> 00:21:49,441  
IT'S ONE OF MANY THINGS

878  
00:21:49,441 --> 00:21:51,276  
THAT WE LOOK FOR.

879  
00:21:51,276 --> 00:21:52,344  
SO THE WAY WE KEEP SURFACES

880  
00:21:52,344 --> 00:21:54,880  
CLEAN-- IT'S MANY, MANY

881  
00:21:54,880 --> 00:21:56,415  
DIFFERENT WAYS THAT WE USE,

882  
00:21:56,415 --> 00:21:57,783  
UH, ONE OF WHICH IS HEAT

883  
00:21:57,783 --> 00:21:59,151  
MICROBially REDUCING

884  
00:21:59,151 --> 00:22:01,219  
THE SPACECRAFT AND ESSENTIALLY

885  
00:22:01,219 --> 00:22:03,021  
WE PUT THE SPACECRAFT AT

886  
00:22:03,021 --> 00:22:04,656  
VARIOUS COMPONENT LEVELS

887  
00:22:04,656 --> 00:22:05,924  
INTO THE OVEN.

888  
00:22:05,924 --> 00:22:06,925

IT REDUCES THE AMOUNT OF

889

00:22:06,925 --> 00:22:09,327

MICROBES PRESENT ON THE SURFACE,

890

00:22:09,327 --> 00:22:10,862

AND THEN THAT ALLOWS US

891

00:22:10,862 --> 00:22:12,964

TO CLEAN THE SPACECRAFT.

892

00:22:12,964 --> 00:22:13,932

WE ALSO BUILD IT

893

00:22:13,932 --> 00:22:15,534

IN A CLEAN ROOM,

894

00:22:15,534 --> 00:22:16,568

AND IN THAT CLEAN ROOM,

895

00:22:16,568 --> 00:22:17,469

WE'RE WEARING BODYSUITS

896

00:22:17,469 --> 00:22:18,537

HEAD TO TOE.

897

00:22:18,537 --> 00:22:19,571

IT KEEPS THE BIGGEST RISK

898

00:22:19,571 --> 00:22:21,406

OF CONTAMINATION, US,

899

00:22:21,406 --> 00:22:23,508

SEPARATE FROM CONTAMINATING

900

00:22:23,508 --> 00:22:25,243

THE SPACECRAFT.

901  
00:22:25,243 --> 00:22:26,178  
WE ALSO WIPE IT DOWN

902  
00:22:26,178 --> 00:22:28,046  
WITH ISOPROPYL ALCOHOL,

903  
00:22:28,046 --> 00:22:29,448  
A 70/30 MIX.

904  
00:22:29,448 --> 00:22:30,382  
AND THE NICE THING IS,

905  
00:22:30,382 --> 00:22:30,949  
THIS IS SOMETHING THAT

906  
00:22:30,949 --> 00:22:32,217  
YOU CAN DO AT HOME.

907  
00:22:32,217 --> 00:22:33,285  
SO AS YOU-- AS YOU CLEAN

908  
00:22:33,285 --> 00:22:34,753  
YOUR SURFACES OFF AT HOME,

909  
00:22:34,753 --> 00:22:35,520  
YOU CAN THINK, WOW,

910  
00:22:35,520 --> 00:22:36,154  
THIS IS THE SAME THING

911  
00:22:36,154 --> 00:22:37,289  
THAT THEY DO TO

912  
00:22:37,289 --> 00:22:38,724  
KEEP SPACECRAFTS CLEAN.

913  
00:22:38,724 --> 00:22:39,658

## HOPEFULLY YOU LEARNED

914

00:22:39,658 --> 00:22:41,093

SOMETHING NEW.

915

00:22:41,093 --> 00:22:43,862

THANKS FOR VISITING.

916

00:22:43,862 --> 00:22:44,763

>> IT TAKES THOUSANDS OF

917

00:22:44,763 --> 00:22:46,431

PEOPLE AND YEARS OF HARD WORK

918

00:22:46,431 --> 00:22:47,632

TO GET A SPACECRAFT

919

00:22:47,632 --> 00:22:49,234

FROM EARTH TO MARS.

920

00:22:49,234 --> 00:22:50,602

FROM FINDING POTENTIAL LANDING

921

00:22:50,602 --> 00:22:52,070

SITES TO BRINGING TOGETHER

922

00:22:52,070 --> 00:22:54,306

MANY ENGINEERS AND SCIENTISTS,

923

00:22:54,306 --> 00:22:55,607

NASA IS ON THE ROAD

924

00:22:55,607 --> 00:22:57,175

TO LAUNCH PERSEVERANCE

925

00:22:57,175 --> 00:22:58,944

IN LESS THAN A WEEK.

926  
00:22:58,944 --> 00:23:00,045  
WE HAVE EXCITING INFORMATION

927  
00:23:00,045 --> 00:23:00,812  
FOR YOU AT THE END OF

928  
00:23:00,812 --> 00:23:02,147  
THE EPISODE TO JOIN

929  
00:23:02,147 --> 00:23:03,782  
THE GLOBAL WATCH PARTY,

930  
00:23:03,782 --> 00:23:05,050  
SO STAY TUNED.

931  
00:23:05,050 --> 00:23:05,951  
BUT FIRST,

932  
00:23:05,951 --> 00:23:07,919  
LET'S TAKE A CLOSER LOOK

933  
00:23:07,919 --> 00:23:09,020  
AT ALL THE PEOPLE

934  
00:23:09,020 --> 00:23:10,922  
BEHIND THE SPACECRAFT.

935  
00:23:12,357 --> 00:23:12,891  
>> WHEN YOU GO TO

936  
00:23:12,891 --> 00:23:13,759  
ANOTHER PLANET,

937  
00:23:13,759 --> 00:23:14,459  
THERE'S JUST SO MUCH

938  
00:23:14,459 --> 00:23:15,060

POTENTIAL FOR MAKING

939

00:23:15,060 --> 00:23:16,294  
BRAND NEW DISCOVERIES.

940

00:23:16,294 --> 00:23:17,229  
>> I'M ACTUALLY PUTTING

941

00:23:17,229 --> 00:23:17,996  
SOMETHING TOGETHER

942

00:23:17,996 --> 00:23:19,331  
THAT'S FLYING TO MARS.

943

00:23:19,331 --> 00:23:20,165  
>> ONE WAY OR ANOTHER,

944

00:23:20,165 --> 00:23:20,832  
YOU'RE GOING TO BE ON

945

00:23:20,832 --> 00:23:22,000  
THE GROUND IN SEVEN MINUTES.

946

00:23:22,000 --> 00:23:24,169  
WE WANT IT TO BE THERE SAFELY.

947

00:23:24,169 --> 00:23:25,170  
>> MY NAME IS HEATHER BOTTOM

948

00:23:25,170 --> 00:23:26,037  
AND I'M HELPING PREPARE

949

00:23:26,037 --> 00:23:27,139  
THE SPACECRAFT THAT WILL FLY

950

00:23:27,139 --> 00:23:28,507  
OUR NEXT MARS ROVER TO

951  
00:23:28,507 --> 00:23:29,474  
THE MARTIAN SURFACE.

952  
00:23:29,474 --> 00:23:30,442  
>> MY NAME IS DIANA TRUJILLO

953  
00:23:30,442 --> 00:23:31,710  
AND I WORK WITH ROBOTIC ARMS

954  
00:23:31,710 --> 00:23:33,245  
TO COLLECT SAMPLES ON MARS.

955  
00:23:33,245 --> 00:23:34,146  
>> I'M AL CHEN AND I LEAD

956  
00:23:34,146 --> 00:23:35,947  
THE LANDING TEAM FOR MARS 2020.

957  
00:23:35,947 --> 00:23:36,381  
>> MY NAME IS

958  
00:23:36,381 --> 00:23:37,382  
MICHELLE TOMEY COLIZZI.

959  
00:23:37,382 --> 00:23:37,916  
>> MY NAME IS

960  
00:23:37,916 --> 00:23:38,583  
MOOGEA STRICKER.

961  
00:23:38,583 --> 00:23:39,551  
>> MY NAME'S ERIC AGUILAR.

962  
00:23:39,551 --> 00:23:40,018  
>> MY NAME IS

963  
00:23:40,018 --> 00:23:40,952

KATIE STACK MORGAN.

964

00:23:40,952 --> 00:23:42,154

>> AND I'M HELPING TO PROTECT

965

00:23:42,154 --> 00:23:43,922

THE NEXT MARS ROVER.

966

00:23:43,922 --> 00:23:45,257

>> MARS 2020 WILL BE SEEKING

967

00:23:45,257 --> 00:23:46,424

SIGNS OF ANCIENT LIFE IN

968

00:23:46,424 --> 00:23:47,659

THE ROCK RECORD OF MARS.

969

00:23:47,659 --> 00:23:48,493

>> WHAT WE'RE TRYING TO DO IS

970

00:23:48,493 --> 00:23:49,661

TO ROVER AROUND THE SURFACE

971

00:23:49,661 --> 00:23:51,596

OF THIS UNKNOWN PLANET.

972

00:23:51,596 --> 00:23:52,597

>> COLLECT SAMPLES.

973

00:23:52,597 --> 00:23:53,431

>> PROCESS THE TUBES

974

00:23:53,431 --> 00:23:54,332

AS THEY COME BACK.

975

00:23:54,332 --> 00:23:55,033

>> TO LOOK FOR THINGS THAT

976

00:23:55,033 --> 00:23:56,268

WE CALL BIOSIGNATURES.

977

00:23:56,268 --> 00:23:57,502

>> SO THAT EVENTUALLY WE CAN

978

00:23:57,502 --> 00:23:58,804

BRING THOSE SAMPLES BACK TO

979

00:23:58,804 --> 00:23:59,704

EARTH AND DETERMINE FOR

980

00:23:59,704 --> 00:24:01,173

THE VERY FIRST TIME,

981

00:24:01,173 --> 00:24:02,874

DID LIFE EXIST ON MARS?

982

00:24:02,874 --> 00:24:03,842

>> BUT ALSO, WHERE COULD IT

983

00:24:03,842 --> 00:24:05,043

BE PRESERVED FOR

984

00:24:05,043 --> 00:24:06,077

FOUR MORE BILLION YEARS

985

00:24:06,077 --> 00:24:07,078

FOR US TO FIND IT?

986

00:24:07,078 --> 00:24:07,579

>> BEFORE THE ROVER

987

00:24:07,579 --> 00:24:08,413

ACTUALLY FLIES,

988

00:24:08,413 --> 00:24:09,014

YOU HAVE TO MAKE SURE THAT

989

00:24:09,014 --> 00:24:10,148

EVERYTHING WORKS PROPERLY

990

00:24:10,148 --> 00:24:11,416

WITH THE FLIGHT SOFTWARE

991

00:24:11,416 --> 00:24:12,317

AND THE HARDWARE.

992

00:24:12,317 --> 00:24:13,318

>> WE HIT THE ATMOSPHERE GOING,

993

00:24:13,318 --> 00:24:14,352

YOU KNOW, 12-13,000

994

00:24:14,352 --> 00:24:15,120

MILES PER HOUR.

995

00:24:15,120 --> 00:24:16,188

>> AFTER THE JOURNEY THROUGH

996

00:24:16,188 --> 00:24:17,956

SPACE, THROUGH THE VACUUM.

997

00:24:17,956 --> 00:24:19,925

>> WE TRY TO TEST ALL OF OUR

998

00:24:19,925 --> 00:24:21,126

HARDWARE TO THE ENVIRONMENTS

999

00:24:21,126 --> 00:24:22,327

THAT WE WOULD SEE.

1000

00:24:22,327 --> 00:24:22,994

>> SO THAT'S WHERE A LOT OF

1001

00:24:22,994 --> 00:24:24,129

THE TESTING HAPPENS,

1002

00:24:24,129 --> 00:24:24,930

UH, BEHIND ME.

1003

00:24:24,930 --> 00:24:25,797

>> WE SPEND LOTS AND LOTS OF

1004

00:24:25,797 --> 00:24:27,599

HOURS HERE TESTING EVERYTHING.

1005

00:24:27,599 --> 00:24:28,800

>> IT GETS PUT IN AN OVEN,

1006

00:24:28,800 --> 00:24:29,968

IT GETS PUT IN VARIOUS

1007

00:24:29,968 --> 00:24:31,269

CHAMBERS AND CLEAN ROOMS.

1008

00:24:31,269 --> 00:24:31,970

>> SO WHAT WE CAN SEE

1009

00:24:31,970 --> 00:24:33,138

OVER HERE IS

1010

00:24:33,138 --> 00:24:35,006

THE STACKED SPACECRAFT.

1011

00:24:35,006 --> 00:24:35,807

>> THE ROBOTIC ARM IS

1012

00:24:35,807 --> 00:24:37,275

ACTUALLY RIGHT BEHIND ME.

1013

00:24:37,275 --> 00:24:38,009

>> THIS IS THE PLACE WHERE

1014

00:24:38,009 --> 00:24:39,044

THE MAGIC HAPPENS.

1015

00:24:39,044 --> 00:24:39,878

>> THIS IS THE MARS YARD,

1016

00:24:39,878 --> 00:24:40,946

AND THIS IS WHERE OUR ROVERS

1017

00:24:40,946 --> 00:24:41,746

PRACTICE DRIVING OVER

1018

00:24:41,746 --> 00:24:42,848

ROCKY TERRAIN.

1019

00:24:42,848 --> 00:24:43,648

>> THERE ARE HUNDREDS

1020

00:24:43,648 --> 00:24:44,282

OF PEOPLE THAT

1021

00:24:44,282 --> 00:24:45,183

HAVE TO COME TOGETHER

1022

00:24:45,183 --> 00:24:46,551

AND BUILD A SPACECRAFT.

1023

00:24:46,551 --> 00:24:47,352

>> YOU KIND OF HAVE TO PUT THOSE

1024

00:24:47,352 --> 00:24:48,420

DIFFERENT PIECES TOGETHER

1025

00:24:48,420 --> 00:24:49,154

AND MAKE SURE THAT THOSE

1026  
00:24:49,154 --> 00:24:50,722  
PIECES ALL ARE GONNA WORK.

1027  
00:24:50,722 --> 00:24:51,223  
>> AND I FEEL LIKE

1028  
00:24:51,223 --> 00:24:53,124  
SUCH A LUCKY PERSON

1029  
00:24:53,124 --> 00:24:54,459  
TO BE WORKING ON THIS.

1030  
00:24:54,459 --> 00:24:55,227  
>> EVERYTHING THAT YOU'RE

1031  
00:24:55,227 --> 00:24:56,561  
TOUCHING ALL IS HARD WORK

1032  
00:24:56,561 --> 00:24:57,395  
THAT YOU'RE PUTTING IN

1033  
00:24:57,395 --> 00:24:58,430  
IN THE LONG HOURS.

1034  
00:24:58,430 --> 00:24:59,431  
>> TWENTY YEARS THE CHILDREN

1035  
00:24:59,431 --> 00:25:00,265  
WILL BE READING THIS IN

1036  
00:25:00,265 --> 00:25:00,999  
THEIR SCIENCE BOOK.

1037  
00:25:00,999 --> 00:25:01,900  
>> IT FEELS GREAT.

1038  
00:25:01,900 --> 00:25:03,702

[ LAUGHING ]

1039

00:25:05,670 --> 00:25:06,605

>> THERE WILL BE A GLOBAL

1040

00:25:06,605 --> 00:25:07,739

LAUNCH PARTY TO WATCH

1041

00:25:07,739 --> 00:25:09,007

AND CELEBRATE THE LAUNCH OF

1042

00:25:09,007 --> 00:25:11,142

NASA'S PERSEVERANCE ROVER.

1043

00:25:11,142 --> 00:25:12,744

LET'S LEARN A LITTLE BIT MORE

1044

00:25:12,744 --> 00:25:14,045

ABOUT THIS ROVING ROBOT

1045

00:25:14,045 --> 00:25:15,247

HEADING TO MARS.

1046

00:25:15,247 --> 00:25:16,181

FOR THAT, I'M JOINED BY

1047

00:25:16,181 --> 00:25:17,382

FLIGHT SYSTEM MANAGER,

1048

00:25:17,382 --> 00:25:18,984

RAY BAKER.

1049

00:25:18,984 --> 00:25:19,618

THANK YOU SO MUCH FOR

1050

00:25:19,618 --> 00:25:21,853

JOINING US TODAY, RAY.

1051  
00:25:21,853 --> 00:25:22,420  
>> THANK YOU, RAQUEL,

1052  
00:25:22,420 --> 00:25:23,822  
MY PLEASURE.

1053  
00:25:23,822 --> 00:25:24,456  
>> NOW, CAN YOU

1054  
00:25:24,456 --> 00:25:25,624  
EXPLAIN YOUR ROLE ON

1055  
00:25:25,624 --> 00:25:27,959  
THE MARS 2020 MISSION?

1056  
00:25:27,959 --> 00:25:28,660  
>> YEAH, I'M THE FLIGHT

1057  
00:25:28,660 --> 00:25:30,562  
SYSTEM MANAGER FOR MARS 2020,

1058  
00:25:30,562 --> 00:25:31,529  
SO I MANAGE THE GROUP OF

1059  
00:25:31,529 --> 00:25:32,864  
PEOPLE, ENGINEERS,

1060  
00:25:32,864 --> 00:25:35,066  
TECHNICIANS, SOFTWARE DESIGNERS

1061  
00:25:35,066 --> 00:25:36,868  
THAT DEVELOPED, BUILT,

1062  
00:25:36,868 --> 00:25:38,103  
AND TESTED THE SPACECRAFT.

1063  
00:25:38,103 --> 00:25:38,603

EVERYTHING FROM

1064

00:25:38,603 --> 00:25:39,905

THE HEAT SHIELD,

1065

00:25:39,905 --> 00:25:40,805

TO THE PARACHUTE,

1066

00:25:40,805 --> 00:25:41,907

THE PROPULSION SYSTEMS,

1067

00:25:41,907 --> 00:25:43,174

FLIGHT COMPUTER,

1068

00:25:43,174 --> 00:25:43,675

AND THE SOFTWARE

1069

00:25:43,675 --> 00:25:45,977

THAT RUNS ON IT.

1070

00:25:45,977 --> 00:25:47,078

>> NOW I UNDERSTAND

1071

00:25:47,078 --> 00:25:47,946

WHEN LAUNCHING TO MARS

1072

00:25:47,946 --> 00:25:49,180

THERE'S A SPECIAL WINDOW

1073

00:25:49,180 --> 00:25:50,248

OF TIME THAT OCCURS

1074

00:25:50,248 --> 00:25:53,184

APPROXIMATELY EVERY 26 MONTHS.

1075

00:25:53,184 --> 00:25:55,253

WHY IS THAT AND WHEN IS THAT

1076  
00:25:55,253 --> 00:25:57,422  
WINDOW FOR PERSEVERANCE?

1077  
00:25:57,422 --> 00:25:58,156  
>> IT HAS TO DO WITH

1078  
00:25:58,156 --> 00:25:59,758  
THE ALIGNMENT OF EARTH AND MARS.

1079  
00:25:59,758 --> 00:26:00,392  
WHEN THEY'RE ALIGNED

1080  
00:26:00,392 --> 00:26:01,660  
JUST RIGHT,

1081  
00:26:01,660 --> 00:26:02,761  
WE CAN THROW A MAXIMUM AMOUNT

1082  
00:26:02,761 --> 00:26:05,263  
OF MASS AT THE PLANET.

1083  
00:26:05,263 --> 00:26:06,798  
THAT MEANS BIGGER SPACECRAFT,

1084  
00:26:06,798 --> 00:26:08,266  
MORE PAYLOAD, UM,

1085  
00:26:08,266 --> 00:26:09,134  
MORE THINGS THAT WE CAN DO

1086  
00:26:09,134 --> 00:26:11,603  
ONCE WE GET THERE.

1087  
00:26:11,603 --> 00:26:12,871  
>> AND IF YOU LAUNCH ON

1088  
00:26:12,871 --> 00:26:13,838

A DIFFERENT DAY THAN

1089

00:26:13,838 --> 00:26:15,206

THE INTENDED LAUNCH,

1090

00:26:15,206 --> 00:26:16,675

WILL IT STILL GET THERE

1091

00:26:16,675 --> 00:26:18,777

AT THE SAME TIME?

1092

00:26:18,777 --> 00:26:19,444

>> IT WILL,

1093

00:26:19,444 --> 00:26:21,046

BECAUSE AFTER LAUNCH WE DO

1094

00:26:21,046 --> 00:26:22,080

WHAT'S CALLED A TRAJECTORY

1095

00:26:22,080 --> 00:26:24,783

CORRECTION MANEUVER TO REFINE

1096

00:26:24,783 --> 00:26:26,117

OUR TRAJECTORY SO THAT WE HIT

1097

00:26:26,117 --> 00:26:27,919

THE PLANET NOT ONLY WHERE

1098

00:26:27,919 --> 00:26:29,154

WE WANT TO HIT THE PLANET,

1099

00:26:29,154 --> 00:26:30,121

UH, AT THE LANDING SITE,

1100

00:26:30,121 --> 00:26:31,523

BUT ALSO PRECISELY AT THE TIME

1101

00:26:31,523 --> 00:26:33,992

THAT WE WANNA ARRIVE.

1102

00:26:33,992 --> 00:26:35,160

>> AND ONCE PERSEVERANCE

1103

00:26:35,160 --> 00:26:36,127

LAUNCHES INTO SPACE,

1104

00:26:36,127 --> 00:26:38,496

WHAT HAPPENS NEXT?

1105

00:26:38,496 --> 00:26:39,097

>> AFTER LAUNCH,

1106

00:26:39,097 --> 00:26:40,231

WE PREPARE THE SPACECRAFT

1107

00:26:40,231 --> 00:26:41,132

FOR THE SEVEN-MONTH LONG

1108

00:26:41,132 --> 00:26:42,300

JOURNEY TO MARS.

1109

00:26:42,300 --> 00:26:43,301

WE ADJUST ITS SPIN RATE

1110

00:26:43,301 --> 00:26:44,336

TO ABOUT TWO REVOLUTIONS

1111

00:26:44,336 --> 00:26:45,303

PER MINUTE.

1112

00:26:45,303 --> 00:26:46,504

WE ADJUST THE POINTING RELATIVE

1113

00:26:46,504 --> 00:26:47,505

TO THE SUN AND THE EARTH

1114

00:26:47,505 --> 00:26:48,640

SO WE CAN PRODUCE POWER

1115

00:26:48,640 --> 00:26:49,874

ON THE SOLAR RAYS

1116

00:26:49,874 --> 00:26:50,475

AND SO THAT WE CAN

1117

00:26:50,475 --> 00:26:51,943

COMMUNICATE WITH IT.

1118

00:26:51,943 --> 00:26:52,844

AND WE'LL ALSO PERFORM

1119

00:26:52,844 --> 00:26:53,578

CHECKOUTS OF ALL OF

1120

00:26:53,578 --> 00:26:55,480

THE SUBSYSTEMS TO MAKE SURE

1121

00:26:55,480 --> 00:26:56,581

THAT WE'RE HEALTHY AND READY

1122

00:26:56,581 --> 00:26:58,049

FOR ENTRY, DESCENT, AND LANDING,

1123

00:26:58,049 --> 00:26:58,683

AND THE MISSION

1124

00:26:58,683 --> 00:27:00,952

THAT COMES AFTER.

1125

00:27:00,952 --> 00:27:02,821

>> AND NOW I HAVE AN #askNASA

1126  
00:27:02,821 --> 00:27:03,621  
QUESTION FOR YOU

1127  
00:27:03,621 --> 00:27:04,756  
FROM SOCIAL MEDIA.

1128  
00:27:04,756 --> 00:27:06,858  
SANJIV ON FACEBOOK IS ASKING,

1129  
00:27:06,858 --> 00:27:08,360  
"WHERE IS THE CHIP CONTAINING

1130  
00:27:08,360 --> 00:27:11,062  
MILLIONS OF NAMES SUBMITTED?"

1131  
00:27:11,062 --> 00:27:11,863  
>> SO THAT CHIP IS ON A PIECE

1132  
00:27:11,863 --> 00:27:12,864  
OF STRUCTURE CALLED

1133  
00:27:12,864 --> 00:27:13,965  
THE AFT CROSSBEAM.

1134  
00:27:13,965 --> 00:27:15,100  
IT'S A BRIDGE-LIKE STRUCTURE

1135  
00:27:15,100 --> 00:27:16,801  
THAT'S ON THE BACK OF THE ROVER.

1136  
00:27:16,801 --> 00:27:17,736  
AT THE TOP OF THE BRIDGE IS

1137  
00:27:17,736 --> 00:27:19,304  
A PLAQUE WITH SOME ARTWORK

1138  
00:27:19,304 --> 00:27:20,071

AND THIS CHIP WITH

1139

00:27:20,071 --> 00:27:20,939  
EVERYBODY'S NAME,

1140

00:27:20,939 --> 00:27:23,408  
INCLUDING MINE.

1141

00:27:23,408 --> 00:27:24,009  
>> THAT'S GREAT.

1142

00:27:24,009 --> 00:27:24,976  
MINE'S ON THERE TOO.

1143

00:27:24,976 --> 00:27:25,744  
I'M REALLY EXCITED FOR IT

1144

00:27:25,744 --> 00:27:26,678  
TO GO TO MARS.

1145

00:27:26,678 --> 00:27:28,246  
AND THAT IS ALL THE TIME

1146

00:27:28,246 --> 00:27:29,647  
WE HAVE TODAY.

1147

00:27:29,647 --> 00:27:30,415  
THANK YOU SO MUCH FOR

1148

00:27:30,415 --> 00:27:32,350  
JOINING US, RAY.

1149

00:27:32,350 --> 00:27:33,818  
>> THANK YOU, RAQUEL.

1150

00:27:33,818 --> 00:27:34,619  
>> AND THANK YOU FOR

1151  
00:27:34,619 --> 00:27:36,021  
JOINING US AT HOME.

1152  
00:27:36,021 --> 00:27:37,188  
MAKE SURE YOU TUNE IN TO WATCH

1153  
00:27:37,188 --> 00:27:38,623  
PERSEVERANCE'S LAUNCH TO MARS

1154  
00:27:38,623 --> 00:27:41,893  
NEXT WEEK AT NASA.GOV/LIVE.

1155  
00:27:41,893 --> 00:27:43,228  
YOU CAN ALSO PARTICIPATE IN

1156  
00:27:43,228 --> 00:27:45,430  
THE VIRTUAL NASA SOCIAL EVENT,

1157  
00:27:45,430 --> 00:27:45,997  
WHICH WILL TAKE YOU

1158  
00:27:45,997 --> 00:27:47,098  
BEHIND THE SCENES

1159  
00:27:47,098 --> 00:27:48,266  
AND UP CLOSE WITH NASA

1160  
00:27:48,266 --> 00:27:50,268  
EXPERTS AHEAD OF THE LAUNCH.

1161  
00:27:50,268 --> 00:27:51,669  
YOU CAN USE THE HASHTAG

1162  
00:27:51,669 --> 00:27:52,971  
#COUNTDOWNTOMARS TO JOIN

1163  
00:27:52,971 --> 00:27:54,706

## THE CONVERSATION ONLINE

1164

00:27:54,706 --> 00:27:58,243

AND VISIT NASA.GOV/BEOURGUEST

1165

00:27:58,243 --> 00:28:00,145

AND FOLLOW @NASAPERSEVERE

1166

00:28:00,145 --> 00:28:01,479

ON FACEBOOK AND TWITTER

1167

00:28:01,479 --> 00:28:02,680

FOR THE LATEST UPDATES

1168

00:28:02,680 --> 00:28:04,649

AND WAYS TO GET INVOLVED.

1169

00:28:04,649 --> 00:28:06,251

WE ARE SO EXCITED FOR