



1  
00:00:08,007 --> 00:00:09,709  
>> GOOD AFTERNOON AND WELCOME TO

2  
00:00:09,776 --> 00:00:11,311  
THE SMITHSONIAN SPACE MUSEUM

3  
00:00:11,378 --> 00:00:14,714  
HIRE ON THE NATIONAL MALL IN

4  
00:00:14,781 --> 00:00:15,582  
WASHINGTON, D.C.

5  
00:00:15,648 --> 00:00:17,417  
I'M HERE IN THE PLANETARY

6  
00:00:17,484 --> 00:00:18,752  
SCIENCE IN SPACE HISTORY

7  
00:00:18,818 --> 00:00:20,286  
DEPARTMENT, AND WE'RE HERE TODAY

8  
00:00:20,353 --> 00:00:23,223  
IN OUR "MOVING BEYOND EARTH"

9  
00:00:23,289 --> 00:00:25,058  
GALLERY, THE GALLERY THAT

10  
00:00:25,125 --> 00:00:28,061  
CELEBRATES HUMAN EXPLORATION

11  
00:00:28,128 --> 00:00:28,928  
INTO ORBIT AND BEYOND.

12  
00:00:28,995 --> 00:00:31,464  
THE FOLKS WE'RE GOING TO HEAR

13  
00:00:31,531 --> 00:00:34,601

FROM TODAY HAVE NEVER LEFT THE

14

00:00:34,667 --> 00:00:36,302

EARTH, BUT THEY HAVE EXPLORED

15

00:00:36,369 --> 00:00:39,005

THE OUTER SOLAR SYSTEM AND IN A

16

00:00:39,072 --> 00:00:40,607

SENSE HAVE BEEN OUR

17

00:00:40,673 --> 00:00:42,308

REPRESENTATIVES OUT IN SPACE, TO

18

00:00:42,375 --> 00:00:44,577

THE OUTER PLANETS.

19

00:00:44,644 --> 00:00:46,012

WE'RE HERE TO COMMEMORATE WITH

20

00:00:46,079 --> 00:00:49,048

THEM THE 40TH ANNIVERSARY OF THE

21

00:00:49,115 --> 00:00:50,917

VOYAGE OF SPACECRAFT.

22

00:00:50,984 --> 00:00:53,353

IT WAS AN EMIC MISSION TO

23

00:00:53,420 --> 00:00:55,088

EX-FLOOR THE OUTER PLANETS.

24

00:00:55,155 --> 00:00:56,790

A MISSION THAT TO THIS DAY I

25

00:00:56,856 --> 00:00:58,858

THINK STANDS OUT AS ONE OF THE

26  
00:00:58,925 --> 00:01:01,594  
MOST AMBITIOUS THAT NASA EVER

27  
00:01:01,661 --> 00:01:03,797  
SENT OUT IN THE SOLAR SYSTEM.

28  
00:01:03,863 --> 00:01:06,599  
TO ME THE MISSION HAS PERSONAL

29  
00:01:06,666 --> 00:01:08,368  
RELEVANCE NOT BECAUSE I HAVE

30  
00:01:08,435 --> 00:01:09,302  
EVER INVOLVED WITH IT, BUT

31  
00:01:09,369 --> 00:01:11,204  
BECAUSE AS A CHILD THE

32  
00:01:11,271 --> 00:01:13,106  
ENCOUNTERS WITH THE VARIOUS

33  
00:01:13,173 --> 00:01:16,176  
PLANETS ACTUALLY THE TWO FINAL

34  
00:01:16,242 --> 00:01:17,610  
PLANETS VENUS AND NEPTUNE,

35  
00:01:17,677 --> 00:01:20,647  
HELPED TO DEFINE MY CHILDHOOD

36  
00:01:20,713 --> 00:01:23,750  
AND DEFINE MY OWN UNDERSTANDING

37  
00:01:23,817 --> 00:01:26,286  
OF MY PLACE IN THE SOLAR SYSTEM.

38  
00:01:26,352 --> 00:01:29,722

I WAS TOO YOUNG TO ENJOY THE FLY

39

00:01:29,789 --> 00:01:34,127

BYES OF JUPITER AND SATURN, BUT

40

00:01:34,194 --> 00:01:35,962

NEPTUNE, I REMEMBER QUITE

41

00:01:36,029 --> 00:01:37,730

CLEARLY SEEING THE IMAGES ON THE

42

00:01:37,797 --> 00:01:39,466

EVENING NEWS, AND REALLY BEING

43

00:01:39,532 --> 00:01:40,967

IMPRESSED BY WHAT WE WERE DOING

44

00:01:41,034 --> 00:01:42,635

OUT THERE IN THE SOLAR SYSTEM.

45

00:01:42,702 --> 00:01:44,504

I COULD FEEL THAT I WAS ONE OF

46

00:01:44,571 --> 00:01:47,140

THE FIRST TO SEE THESE PLANETS

47

00:01:47,207 --> 00:01:49,409

IN SUCH GREAT RESOLUTION.

48

00:01:49,476 --> 00:01:51,711

I'M SURE THAT SEVERAL OTHERS OF

49

00:01:51,778 --> 00:01:53,980

YOU, LIKE MYSELF, WHO WERE BORN

50

00:01:54,047 --> 00:01:57,350

IN THE '70S, MIGHT FEEL THE SAME

51  
00:01:57,417 --> 00:01:58,218  
WAY.

52  
00:01:58,284 --> 00:02:00,620  
ALSO, I WANT TO NOTE BEFORE

53  
00:02:00,687 --> 00:02:02,689  
GOING FURTHER THAT WE DO HAVE A

54  
00:02:02,755 --> 00:02:04,724  
WONDERFUL MODEL OF THE VOYAGER

55  
00:02:04,791 --> 00:02:07,727  
SPACECRAFT UPSTAIRS IN OUR

56  
00:02:07,794 --> 00:02:09,429  
"EXPLORING THE PLANETS "GALLERY.

57  
00:02:09,496 --> 00:02:13,533  
THAT IS TRUE TO THE ACTUAL

58  
00:02:13,600 --> 00:02:15,268  
VOYAGER, AND THERE WERE SOME OF

59  
00:02:15,335 --> 00:02:17,070  
THE PARTS USED IN ENGINEERING

60  
00:02:17,136 --> 00:02:19,138  
AND TESTING THE VOYAGER.

61  
00:02:19,205 --> 00:02:21,708  
IF YOU WANT TO SEE THAT

62  
00:02:21,774 --> 00:02:23,676  
SPACECRAFT IN ITS FULL SIZE AND

63  
00:02:23,743 --> 00:02:25,144

GLORY, I SUGGEST YOU TAKE SOME

64

00:02:25,211 --> 00:02:27,180

TIME, IF YOU'RE HERE IN OUR

65

00:02:27,247 --> 00:02:28,815

AUDIENCE, TO GO UPSTAIRS AND

66

00:02:28,882 --> 00:02:30,250

TAKE A LOOK AT THE MODEL.

67

00:02:30,316 --> 00:02:38,925

IF YOU'RE WATCHING US ON

68

00:02:38,992 --> 00:02:41,194

NASATV,comeandtakealookatthatmod

69

00:02:41,261 --> 00:02:47,133

el.

70

00:02:47,200 --> 00:02:51,004

I DON'T THINK YOU'LL BE

71

00:02:51,070 --> 00:02:57,176

DISAPPOINTED.

72

00:02:57,243 --> 00:03:03,316

DR. ZUBRICAN HAS CO-AUTHORED 200

73

00:03:03,383 --> 00:03:03,750

ARTICLES.

74

00:03:03,816 --> 00:03:07,887

HE HAS BEEN INVOLVED IN SEVERAL

75

00:03:07,954 --> 00:03:13,059

NASA SCIENCE MISSIONS, INCLUDING

76  
00:03:13,126 --> 00:03:19,999  
THE ADVANCE COMPOSITION

77  
00:03:20,066 --> 00:03:20,700  
EXPLORER.

78  
00:03:20,767 --> 00:03:23,870  
SO DR. ZUBRICAN.

79  
00:03:23,937 --> 00:03:24,504  
[APPLAUSE]

80  
00:03:24,571 --> 00:03:25,905  
>> WELL, THANKS, EVERYBODY.

81  
00:03:25,972 --> 00:03:29,375  
IT'S REALLY A PLEASURE TO BE

82  
00:03:29,442 --> 00:03:34,981  
HERE WITH YOU TODAY TO CELEBRATE

83  
00:03:35,048 --> 00:03:37,350  
THIS PIONEERING MOMENT FOR BOTH

84  
00:03:37,417 --> 00:03:41,054  
NASA AND EXPLORATION HISTORY OF

85  
00:03:41,120 --> 00:03:41,621  
HUMANITY.

86  
00:03:41,688 --> 00:03:47,460  
HAPPY ANNIVERSARY TO VOYAGER.

87  
00:03:47,527 --> 00:03:48,027  
[APPLAUSE]

88  
00:03:48,094 --> 00:03:50,597

OF COURSE, YOU KNOW THAT ON

89  
00:03:50,663 --> 00:03:54,033  
SEPTEMBER 5TH, FOUR DECADES AGO,

90  
00:03:54,100 --> 00:03:57,737  
1977, NASA LAUNCHED VOYAGER ONE.

91  
00:03:57,804 --> 00:04:01,074  
A LITTLE OVER EIGHT YEARS AFTER

92  
00:04:01,140 --> 00:04:11,050  
THE EIGHT YEARS OF APOLO 11.

93  
00:04:11,117 --> 00:04:15,088  
IT'S A MISSION THAT CHANGED

94  
00:04:15,154 --> 00:04:16,856  
EVERYTHING.

95  
00:04:16,923 --> 00:04:19,859  
IT NOT ONLY CHANGED WHAT WE KNOW

96  
00:04:19,926 --> 00:04:21,327  
BUT HOW WE THINK.

97  
00:04:21,394 --> 00:04:22,862  
AND WHAT WE CAN AND WHAT WE

98  
00:04:22,929 --> 00:04:25,231  
CAN'T DO AS HUMANS.

99  
00:04:25,298 --> 00:04:27,467  
IMAGINE THIS FALL CHILDREN ALL

100  
00:04:27,533 --> 00:04:29,135  
AROUND THE REGION, AROUND THE

101  
00:04:29,202 --> 00:04:30,970  
COUNTRY GOING TO SCHOOL, GETTING

102  
00:04:31,037 --> 00:04:32,572  
THEIR SCHOOL BOOKS AND LOOKING

103  
00:04:32,639 --> 00:04:34,574  
AT THE PICTURES IN THESE BOOKS,

104  
00:04:34,641 --> 00:04:37,076  
AND ESPECIALLY THE PICTURES OF

105  
00:04:37,143 --> 00:04:38,611  
THE PLANETS, MANY OF THESE

106  
00:04:38,678 --> 00:04:44,017  
PICTURES, OF COURSE, ARE REALLY

107  
00:04:44,083 --> 00:04:44,851  
YOUNG.

108  
00:04:44,917 --> 00:04:45,418  
MERCURY HAS PICTURES.

109  
00:04:45,485 --> 00:04:47,620  
I KNOW, I WAS ON THE MISSION

110  
00:04:47,687 --> 00:04:50,189  
TAKING IMAGES THERE.

111  
00:04:50,256 --> 00:04:51,724  
WE LOOK AT MARCHS.

112  
00:04:51,791 --> 00:04:54,060  
AND SOME OF THE MOST AMAZING

113  
00:04:54,127 --> 00:04:55,261

## INVESTIGATIONS GOING ON RIGHT

114

00:04:55,328 --> 00:04:57,830

NOW BOTH ON THE SURFACE AND ON

115

00:04:57,897 --> 00:04:58,564

ORBIT.

116

00:04:58,631 --> 00:04:59,932

THEN WE GO FURTHER OUT.

117

00:04:59,999 --> 00:05:03,836

AND THEN WE GET TO NEPTUNE AND

118

00:05:03,903 --> 00:05:05,638

FRANKLY EVERY PICTURE WE SEE

119

00:05:05,705 --> 00:05:07,807

THERE IT COMES FROM THESE

120

00:05:07,874 --> 00:05:10,243

SPACECRAFT THAT ARE OUT THERE

121

00:05:10,309 --> 00:05:11,477

FROM THE SPACECRAFT THAT FLEW

122

00:05:11,544 --> 00:05:11,811

BY.

123

00:05:11,878 --> 00:05:13,346

THAT ARE OUT THERE, AND WE HAVE

124

00:05:13,413 --> 00:05:14,847

NOT GONE BACK.

125

00:05:14,914 --> 00:05:19,218

TO ME, IT'S ALSO THE BEGINNING

126

00:05:19,285 --> 00:05:22,388

OF MY INTEREST.

127

00:05:22,455 --> 00:05:24,991

JUST WHEN I WAS A LITTLE BIT

128

00:05:25,058 --> 00:05:27,560

UNDER 10 YEARS OLD, WAS TO

129

00:05:27,627 --> 00:05:30,997

CELEBRATE THE UPCOMING LAUNCH OF

130

00:05:31,064 --> 00:05:34,233

VOYAGER, THE FIRST VOYAGER, AND

131

00:05:34,300 --> 00:05:35,001

VOYAGER TWO.

132

00:05:35,068 --> 00:05:36,536

I HAD THIS BOOK WITH ME AND

133

00:05:36,602 --> 00:05:37,937

STILL IN MY OFFICE.

134

00:05:38,004 --> 00:05:40,339

IF YOU'RE HERE WITH ME AT

135

00:05:40,406 --> 00:05:43,509

HEADQUARTERS, COME LOOK AT MY

136

00:05:43,576 --> 00:05:46,546

VOYAGER BOOK.

137

00:05:46,612 --> 00:05:48,715

EVEN IF WE WERE NOT FORTUNATE

138

00:05:48,781 --> 00:05:50,183

ENOUGH TO BE THERE WITH HANDS ON

139

00:05:50,249 --> 00:05:52,552

LIKE SO MANY OF THE PEOPLE WE'RE

140

00:05:52,618 --> 00:05:55,421

GOING TO HEAR ABOUT.

141

00:05:55,488 --> 00:05:57,190

SO VOYAGER TODAY EFFECT THE

142

00:05:57,256 --> 00:05:58,891

LIVES OF CHILDREN ALL AGES ALL

143

00:05:58,958 --> 00:06:01,227

OVER THE WORLD.

144

00:06:01,294 --> 00:06:04,697

KNOW THAT CHILDREN WERE NOT BORN

145

00:06:04,764 --> 00:06:06,532

WHEN VOYAGER WAS STILL ON THE

146

00:06:06,599 --> 00:06:07,400

GROUND.

147

00:06:07,467 --> 00:06:09,335

NOT EVEN OF THEIR PARENTS WERE

148

00:06:09,402 --> 00:06:13,172

BORN, AND HALF HUMANITY WAS NOT

149

00:06:13,239 --> 00:06:15,408

BORN WHEN VOYAGER WAS LAUNCHED.

150

00:06:15,475 --> 00:06:17,176

REALLY WHAT WE'RE CELEBRATING

151  
00:06:17,243 --> 00:06:19,378  
TODAY IS 40 YEARS OF DISCOVERY

152  
00:06:19,445 --> 00:06:22,248  
AND EXPLORATION HISTORY

153  
00:06:22,315 --> 00:06:23,983  
ECLIPSING EVERYBODY'S

154  
00:06:24,050 --> 00:06:25,518  
EXPECTATION.

155  
00:06:25,585 --> 00:06:27,987  
NEARLY 40 YEARS LATER THE

156  
00:06:28,054 --> 00:06:30,289  
SUCCESSFUL VOYAGER RUN CONTINUE

157  
00:06:30,356 --> 00:06:33,760  
TO PROVIDE US WITH UNPRECEDENTED

158  
00:06:33,826 --> 00:06:39,499  
INFORMATION ABOUT THE PLACE AND

159  
00:06:39,565 --> 00:06:40,099  
EVENT.

160  
00:06:40,166 --> 00:06:42,168  
VOYAGER HAS TRAVELED

161  
00:06:42,235 --> 00:06:43,569  
14 BILLION MILES FROM EARTH, THE

162  
00:06:43,636 --> 00:06:45,471  
FARTHEST OF ANY SPACECRAFT.

163  
00:06:45,538 --> 00:06:47,473

IT IS NOW TRAVELING THROUGH THE

164

00:06:47,540 --> 00:06:52,311

EMPTINESS AND LONELINESS OF

165

00:06:52,378 --> 00:06:53,379

INTERSTELLAR SPACE HAVING LEFT

166

00:06:53,446 --> 00:06:54,313

THE SUN.

167

00:06:54,380 --> 00:06:58,184

IT'S EXPECTED TO TRANSMIT DATA

168

00:06:58,251 --> 00:07:00,920

UNTIL 2025.

169

00:07:00,987 --> 00:07:04,690

VOYAGER IS APPROACHING THE

170

00:07:04,757 --> 00:07:06,726

BOUNDARY, AND IT'S STILL GOING.

171

00:07:06,793 --> 00:07:12,231

AS I SAID, VOYAGER IS THE APOLO

172

00:07:12,298 --> 00:07:15,201

11 FOR THE SPACE BEYOND AND

173

00:07:15,268 --> 00:07:16,202

BEYOND THE IMAGINABLE.

174

00:07:16,269 --> 00:07:19,872

IT IS A MISSION DRIVEN BY

175

00:07:19,939 --> 00:07:22,875

SCIENTIFIC RESEARCH AND A

176  
00:07:22,942 --> 00:07:25,878  
MISSION OF PIONEERING AND

177  
00:07:25,945 --> 00:07:26,412  
EXPLORATION.

178  
00:07:26,479 --> 00:07:28,181  
A MISSION THAT HAS OPENED

179  
00:07:28,247 --> 00:07:31,450  
ENTIRELY NEW QUESTIONS THAT KEEP

180  
00:07:31,517 --> 00:07:38,291  
US AWAKE TODAY.

181  
00:07:38,357 --> 00:07:41,794  
IN ITS LAST ORBIT IT'S HARD TO

182  
00:07:41,861 --> 00:07:43,663  
IMAGINE WITHOUT VOYAGER AHEAD OF

183  
00:07:43,729 --> 00:07:44,197  
IT.

184  
00:07:44,263 --> 00:07:46,766  
THE IMAGES ARE ALL LOWER

185  
00:07:46,833 --> 00:07:47,934  
MONITORS TODAY.

186  
00:07:48,000 --> 00:07:53,506  
WE THINK OF IT, AND THE ICY

187  
00:07:53,573 --> 00:07:56,042  
SURFACE STARTING WITH VOYAGER.

188  
00:07:56,108 --> 00:07:58,311

EVERY 50 DAYS OR SO WE LOOK AT

189

00:07:58,377 --> 00:08:01,180

NEW IMAGES FROM JUNO TO

190

00:08:01,247 --> 00:08:02,582

INVESTIGATE THE MISSION.

191

00:08:02,648 --> 00:08:06,752

AND OF COURSE, REMEMBER GALILEO,

192

00:08:06,819 --> 00:08:10,456

ONE OF THE MOST RECENT PASSES OF

193

00:08:10,523 --> 00:08:12,725

JUPITER'S GIGANTIC STORE THAT

194

00:08:12,792 --> 00:08:15,328

LASTED FOR A MILLENNIA, AND IT

195

00:08:15,394 --> 00:08:19,131

IS GETTING WEAKER.

196

00:08:19,198 --> 00:08:25,905

WE IMAGINE EXPLORING ONE OF

197

00:08:25,972 --> 00:08:28,040

JUPITER'S MOONS.

198

00:08:28,107 --> 00:08:31,043

AND A WHOLE OCEAN TO BE

199

00:08:31,110 --> 00:08:31,777

EXPLORED.

200

00:08:31,844 --> 00:08:33,079

IN FACT, WE PUT AN ANNOUNCEMENT

201  
00:08:33,145 --> 00:08:34,747  
OUT TO THE SCIENCE COMMUNITY TO

202  
00:08:34,814 --> 00:08:37,083  
MAKE THE NEXT STEP TOWARDS

203  
00:08:37,149 --> 00:08:38,284  
UNDERSTANDING THE BOUNDARY OF

204  
00:08:38,351 --> 00:08:41,687  
THE SUN THAT HE LIVES HERE, AND

205  
00:08:41,754 --> 00:08:45,091  
THIS MISSION, AS WE CALL IT, IS

206  
00:08:45,157 --> 00:08:46,292  
TO MAP OUT THIS EXPLORATION

207  
00:08:46,359 --> 00:08:50,997  
REGION OUT THERE, AND ALSO

208  
00:08:51,063 --> 00:08:55,201  
CONDUCT INTERSTELLAR RESEARCH IN

209  
00:08:55,268 --> 00:08:57,036  
WAYS WE HAVE NEVER DONE BEFORE.

210  
00:08:57,103 --> 00:08:59,906  
WHAT IS STREAMING EVEN BIGGER,

211  
00:08:59,972 --> 00:09:01,374  
THESE TECHNOLOGIES IN A WE HAVE

212  
00:09:01,440 --> 00:09:05,378  
TODAY ALLOW US TO GO THE

213  
00:09:05,444 --> 00:09:06,145

DISTANCE.

214

00:09:06,212 --> 00:09:07,747

WE WANT TO GO FURTHER.

215

00:09:07,813 --> 00:09:11,150

WE WANT TO GO FASTER, AND WE'RE

216

00:09:11,217 --> 00:09:11,984

DREAMING, TOGETHER WITH THE

217

00:09:12,051 --> 00:09:14,754

CHILDREN OF THIS WORLD ABOUT

218

00:09:14,820 --> 00:09:16,389

GOING TO OUTER STARS.

219

00:09:16,455 --> 00:09:20,192

THAT'S THE DIRECTION VOYAGER HAS

220

00:09:20,259 --> 00:09:20,793

ADVANCED.

221

00:09:20,860 --> 00:09:24,330

I WANT TO CONGRATULATE ALL THE

222

00:09:24,397 --> 00:09:25,898

GENERATIONS OF THE VOYAGER TEAM.

223

00:09:25,965 --> 00:09:27,466

REMEMBER THE ONES WHO ARE NO

224

00:09:27,533 --> 00:09:29,702

LONGER WITH US, AND WE CELEBRATE

225

00:09:29,769 --> 00:09:33,472

THE ONES WHO ARE MAKING VOYAGER

226

00:09:33,539 --> 00:09:39,578

WORK TODAY ALL THE WAY TO

227

00:09:39,645 --> 00:09:42,515

AUSTRALIA.

228

00:09:42,581 --> 00:09:44,216

CONGRATULATIONS AND

229

00:09:44,283 --> 00:09:46,419

ENCOURAGEMENT GOES TO SQUEEZING

230

00:09:46,485 --> 00:09:47,620

EVERY OUNCE OF SCIENCE OUT OF

231

00:09:47,687 --> 00:09:51,390

THESE BITS, THESE RARE AND

232

00:09:51,457 --> 00:09:54,260

PRECIOUS BITS COMING TO US.

233

00:09:54,327 --> 00:09:58,631

SO I WANT TO THANK SUSAN DOBBS,

234

00:09:58,698 --> 00:10:03,769

THE CURRENT VOYAGER PROJECT

235

00:10:03,836 --> 00:10:05,438

MANAGER WHO WORKED ON THIS

236

00:10:05,504 --> 00:10:07,573

MISSION SINCE 1948, AND MANY OF

237

00:10:07,640 --> 00:10:10,009

HER FRIENDS--I KNOW ANDREA, OF

238

00:10:10,076 --> 00:10:12,611

COURSE, I WORKED WITH HER.

239

00:10:12,678 --> 00:10:15,681

I'M SO EXCITED TO WELCOME YOU

240

00:10:15,748 --> 00:10:17,750

ALL FROM JPL, MANY OF YOU

241

00:10:17,817 --> 00:10:19,552

STARTED IN THE 80s, AND SOME

242

00:10:19,618 --> 00:10:21,821

OF YOU STARTED MORE RECENTLY.

243

00:10:21,887 --> 00:10:23,689

WE WON'T SAY WHO, BUT I'M REALLY

244

00:10:23,756 --> 00:10:25,458

EXCITED THAT YOU'RE HERE AND

245

00:10:25,524 --> 00:10:27,793

CELEBRATING WITH US.

246

00:10:27,860 --> 00:10:30,396

DR. STONE, MY FRIEND FOR

247

00:10:30,463 --> 00:10:33,199

DECADES, THE RETIRED DIRECTOR

248

00:10:33,265 --> 00:10:36,469

FROM NASA, AND ON THE VOYAGER

249

00:10:36,535 --> 00:10:42,942

PROJECT TEAM SINCE 1972, AND ONE

250

00:10:43,009 --> 00:10:44,810

OF THE KEY CONTRIBUTORS TO THE

251  
00:10:44,877 --> 00:10:47,013  
SCIENCE.

252  
00:10:47,079 --> 00:10:54,253  
AND ADRIAN COWROTE SIX NEW YORK

253  
00:10:54,320 --> 00:10:56,589  
BESS SELLERS WITH CARL SAGAN, SO

254  
00:10:56,655 --> 00:10:57,857  
THANK YOU FOR ALL THE WORK

255  
00:10:57,923 --> 00:11:07,733  
YOU'VE DONE.

256  
00:11:07,800 --> 00:11:10,202  
>> GARY, AN INNOVATIVE, WHO

257  
00:11:10,269 --> 00:11:12,805  
GRANTED A MULTI PLANET MISSION

258  
00:11:12,872 --> 00:11:14,807  
TO REDUCE THE MISSION DURATION

259  
00:11:14,874 --> 00:11:16,642  
FROM 40 YEARS TO LESS THAN 10

260  
00:11:16,709 --> 00:11:17,176  
YEARS.

261  
00:11:17,243 --> 00:11:24,784  
AND NASA USES OF COURSE, VOYAGER

262  
00:11:24,850 --> 00:11:29,088  
1 AND VOYAGER 2 MISSIONS.

263  
00:11:29,155 --> 00:11:31,991

AND ONE OF THE FUNNIEST GUYS AT

264

00:11:32,058 --> 00:11:33,959

ANY PARTY YOU'LL GO TO--YOU KNOW

265

00:11:34,026 --> 00:11:50,443

WHAT I MEAN--WORK WITH ED STONE.

266

00:11:50,509 --> 00:11:55,648

AND I WANT TO THANK THEM FOR

267

00:11:55,714 --> 00:11:58,517

HOSTING US.

268

00:11:58,584 --> 00:12:00,686

I COME HERE WITH MY CHILDREN OR

269

00:12:00,753 --> 00:12:07,226

BY MYSELF, THEY ALL PERFORM A

270

00:12:07,293 --> 00:12:15,501

REMARKABLE SERVICE EDUCATING.

271

00:12:15,568 --> 00:12:18,270

TO DRIVE US TO KEEP PUSHING

272

00:12:18,337 --> 00:12:19,572

AGAINST IGNORANCE OF

273

00:12:19,638 --> 00:12:22,408

RESEARCHERS.

274

00:12:22,475 --> 00:12:24,677

WHAT I WOULD LIKE TO DO IS KICK

275

00:12:24,743 --> 00:12:27,580

OFF A MOVIE MADE FOR THIS EVENT.

276

00:12:27,646 --> 00:12:28,314

THANK YOU SO MUCH.

277

00:14:54,159 --> 00:14:46,385

[APPLAUSE]

278

00:14:54,226 --> 00:14:56,195

>> IT'S NOW MY PLEASURE TO

279

00:14:56,262 --> 00:15:00,065

INTRODUCE OUR FIRST PANEL OF THE

280

00:15:00,132 --> 00:15:02,101

DAY.

281

00:15:02,167 --> 00:15:03,769

THEY HAVE ALREADY BEEN GIVEN

282

00:15:03,836 --> 00:15:05,537

PRETTY GOOD INTRODUCTIONS.

283

00:15:05,604 --> 00:15:08,073

WE HAVE DR. ED STONE, WHO HAS

284

00:15:08,140 --> 00:15:11,744

BEEN A PROJECT SCIENTIST ON

285

00:15:11,810 --> 00:15:13,646

VOYAGER FROM 1972 TO THE

286

00:15:13,712 --> 00:15:14,246

PRESENT.

287

00:15:14,313 --> 00:15:17,750

WE HAVE DR. GARY FLANDRO, THE

288

00:15:17,816 --> 00:15:18,851

BOILING CHAIR AT THE UNIVERSITY

289

00:15:18,917 --> 00:15:22,187

OF TENNESSEE'S SPACE INSTITUTE,

290

00:15:22,254 --> 00:15:26,859

AND WHO WAS THE FIRST TO PROPOSE

291

00:15:26,925 --> 00:15:28,694

THE GRAND TOUR MULTI PLANET

292

00:15:28,761 --> 00:15:31,130

EXPLORATION OF THE OUTER

293

00:15:31,196 --> 00:15:31,597

PLANETS.

294

00:15:31,664 --> 00:15:35,501

WE HAVE ALAN CUMMINGS.

295

00:15:35,567 --> 00:15:39,371

ALAN CUMMINGS HAS BEEN EMPLOYED

296

00:15:39,438 --> 00:15:42,708

AT CALTECH SINCE 1973, AND HE'S

297

00:15:42,775 --> 00:15:44,977

PRESENTLY A CURRENT SENIOR

298

00:15:45,044 --> 00:15:46,445

SCIENTIST AND MEMBER OF THE

299

00:15:46,512 --> 00:15:47,413

PROFESSIONAL STAFF THERE.

300

00:15:47,479 --> 00:15:52,685

WE HAVE SUSAN DOBBS, JPL

301  
00:15:52,751 --> 00:15:55,387  
DIRECTOR OF THE INTERPLAN TORE

302  
00:15:55,454 --> 00:15:57,623  
DIRECTORATE, AND SHE HAS OVER 30

303  
00:15:57,690 --> 00:16:00,092  
YEARS EXPERIENCE SERVING A

304  
00:16:00,159 --> 00:16:01,760  
PROJECT MANAGER ROLE OF VOYAGER

305  
00:16:01,827 --> 00:16:02,928  
AND OTHER MISSIONS.

306  
00:16:02,995 --> 00:16:06,965  
AND WE HAVE ANDREA, AND AND

307  
00:16:07,032 --> 00:16:09,401  
AUTHOR AND LECTURER, MOTION

308  
00:16:09,468 --> 00:16:11,403  
PICTURE WRITER AND PRODUCER

309  
00:16:11,470 --> 00:16:14,173  
WHOSE WORK IS LARGELY CONCERNED

310  
00:16:14,239 --> 00:16:16,642  
ABOUT TECHNOLOGY ON OUR

311  
00:16:16,709 --> 00:16:17,343  
CIVILIZATION.

312  
00:16:17,409 --> 00:16:21,447  
SHE WAS WINNER OF PEABODY AWARD

313  
00:16:21,513 --> 00:16:26,218

COSMOS, AND DIRECTOR OF NASA'S

314

00:16:26,285 --> 00:16:28,787

"ENTER STELLAR MESSAGE PROJECT."

315

00:16:28,854 --> 00:16:31,090

I'LL START ASKING OUR PANELISTS

316

00:16:31,156 --> 00:16:33,926

A FEW QUESTIONS, AND WE'LL START

317

00:16:33,992 --> 00:16:37,062

WITH DR. STONE, DR. STONE, WHAT

318

00:16:37,129 --> 00:16:40,299

IS SO SPECIAL ABOUT VOYAGER?

319

00:16:40,366 --> 00:16:42,234

>> WELL, FROM MANY POINTS OF

320

00:16:42,301 --> 00:16:45,637

VIEW VOYAGER REPRESENTS THE MOST

321

00:16:45,704 --> 00:16:47,940

AMBITIOUS JOURNEY OF DISCOVERY.

322

00:16:48,006 --> 00:16:50,342

THAT'S WHAT I THINK IS REALLY

323

00:16:50,409 --> 00:16:51,710

KENNEDY'S LEGACY.

324

00:16:51,777 --> 00:16:54,012

>> AND TELL US ABOUT THE

325

00:16:54,079 --> 00:16:58,350

BEGINNINGS OF THE MISSION.

326

00:16:58,417 --> 00:17:00,919

>> THE VOYAGER BEGAN WHEN THEY

327

00:17:00,986 --> 00:17:05,023

DISCOVERED THAT IT THERE WAS A

328

00:17:05,090 --> 00:17:07,693

YEAR 1997, PLUS OR MINUS A YEAR

329

00:17:07,760 --> 00:17:11,029

WHERE A SINGLE AIRCRAFT COULD BE

330

00:17:11,096 --> 00:17:14,299

LAUNCHED AND FLY BY ALL GIANT

331

00:17:14,366 --> 00:17:15,734

PLANETS, THAT WAS CALLED THE

332

00:17:15,801 --> 00:17:17,569

GRAND TOUR.

333

00:17:17,636 --> 00:17:21,473

IN 1972 THEY WERE DOWN SIZED BY

334

00:17:21,540 --> 00:17:24,376

MARINER JUPITER SATURN FOUR-YEAR

335

00:17:24,443 --> 00:17:27,780

MISSION BETWEEN THOSE TWO GIANT

336

00:17:27,846 --> 00:17:29,948

PLANETS AND THEIR MOONS AND

337

00:17:30,015 --> 00:17:30,382

RINGS.

338

00:17:30,449 --> 00:17:32,418

THAT WAS SUPPOSED TO BE LAUNCHED

339

00:17:32,484 --> 00:17:34,052

IN 1977 SO IF THEY CONTINUED TO

340

00:17:34,119 --> 00:17:38,490

WORK THEY COULD GO ON TO URANIS

341

00:17:38,557 --> 00:17:40,159

AND NEPTUNE AND COMPLETING THE

342

00:17:40,225 --> 00:17:42,361

GRAND TOUR OF THE OUTER PLANETS

343

00:17:42,428 --> 00:17:44,096

HAS GARY HAD PROMISED A WAY TO

344

00:17:44,163 --> 00:17:46,265

DO THAT IN 12 YEARS RATHER THAN

345

00:17:46,331 --> 00:17:46,865

30 YEARS.

346

00:17:46,932 --> 00:17:49,134

SO WE REALLY HAVE HIM TO THANK

347

00:17:49,201 --> 00:17:52,337

THAT WE COULD DO IT IN A 12-YEAR

348

00:17:52,404 --> 00:17:53,138

JOURNEY.

349

00:17:53,205 --> 00:17:55,374

>> VOYAGER HAS MADE MANY

350

00:17:55,441 --> 00:17:55,941

DISCOVERIES.

351  
00:17:56,008 --> 00:17:57,409  
WHAT ARE SOME OF YOUR FAVORITES.

352  
00:17:57,476 --> 00:18:00,279  
>> IF I COULD HAVE THE FIRST

353  
00:18:00,345 --> 00:18:00,712  
SLIDE?

354  
00:18:00,779 --> 00:18:02,815  
IT SHOWS JUPITER IN A GREAT RED

355  
00:18:02,881 --> 00:18:08,353  
SPOT ALONG WITH TWO OF JUPITER'S

356  
00:18:08,420 --> 00:18:09,188  
MOONS.

357  
00:18:09,254 --> 00:18:11,890  
BEFORE VOYAGER, THE ONLY KNOWN

358  
00:18:11,957 --> 00:18:17,496  
ACTIVE VOLCANO IN THE SOLAR

359  
00:18:17,563 --> 00:18:19,465  
SYSTEM--THE ONLY KNOWN ACTIVE

360  
00:18:19,531 --> 00:18:21,033  
VOLCANOS WERE HERE ON EARTH.

361  
00:18:21,099 --> 00:18:25,037  
AND THEN VOYAGER FLEW BY A MOON

362  
00:18:25,103 --> 00:18:27,973  
OF JUPITER ABOUT THE SIZE OF OUR

363  
00:18:28,040 --> 00:18:31,176

MOON TEN TIMES THE VOLCANIC

364

00:18:31,243 --> 00:18:31,743

ACTIVITY.

365

00:18:31,810 --> 00:18:33,378

AND IT IS QUITE A STRIKING

366

00:18:33,445 --> 00:18:35,013

CHANGE WHEN WE REALIZED THAT THE

367

00:18:35,080 --> 00:18:37,249

EARTH WAS NOT LONGER THE MOST

368

00:18:37,316 --> 00:18:39,184

ACTIVE VOLCANIC BODY.

369

00:18:39,251 --> 00:18:42,054

BEFORE EARTH THE ONLY KNOWN

370

00:18:42,120 --> 00:18:43,689

LIQUID WATER OCEANS WERE ON

371

00:18:43,755 --> 00:18:48,427

EARTH, AND THEN VOYAGER COVERED

372

00:18:48,494 --> 00:18:50,829

ONE OF JUPITER'S MOONS AND WE

373

00:18:50,896 --> 00:18:53,332

SAW THAT IT WAS ICE, AND WE SAW

374

00:18:53,398 --> 00:18:58,170

CRACKED ICE AS IF IT WAS ON A

375

00:18:58,237 --> 00:19:00,239

LIQUID WATER OCEAN, IN A WAS

376

00:19:00,305 --> 00:19:01,673

DEMONSTRATED IT WAS, INDEED, THE

377

00:19:01,740 --> 00:19:02,374

FACT.

378

00:19:02,441 --> 00:19:15,220

THERE WAS A LIQUID WATER OCEAN.

379

00:19:15,287 --> 00:19:17,523

ON TO SATURN, ONE OF THE KEY

380

00:19:17,589 --> 00:19:19,925

ISSUES THERE WAS IT'S MOON

381

00:19:19,992 --> 00:19:20,792

TITAN.

382

00:19:20,859 --> 00:19:24,897

BEFORE VOYAGER THE ONLY KNOWN

383

00:19:24,963 --> 00:19:28,400

NITROGEN ATMOSPHERE WAS HERE ON

384

00:19:28,467 --> 00:19:29,434

EARTH.

385

00:19:29,501 --> 00:19:33,205

THEN WE FLEW BY TITAN WHICH HAS

386

00:19:33,272 --> 00:19:36,942

90% HIGHER NITROGEN, AND IT HAS

387

00:19:37,009 --> 00:19:39,211

METHANE IN THE ATMOSPHERE, NOT

388

00:19:39,278 --> 00:19:44,449

OXYGEN, SO IT'S A COMPLEX

389

00:19:44,516 --> 00:19:47,019

ORGANIC MOLECULES THAT CREATES

390

00:19:47,085 --> 00:19:48,587

HAZE AND CANNOT BE SEEN THROUGH.

391

00:19:48,654 --> 00:19:52,824

AND THEN SEVERAL DECADES LATER

392

00:19:52,891 --> 00:19:56,762

WE HAD A RADAR SYSTEM THAT COULD

393

00:19:56,828 --> 00:19:57,896

SEE THROUGH THE HAZE AND THERE

394

00:19:57,963 --> 00:20:02,100

IS LIQUID GAS ON THE MOON,

395

00:20:02,167 --> 00:20:03,735

PERHAPS REPRESENTING WHAT THE

396

00:20:03,802 --> 00:20:05,671

EARTH LOOKED LIKE BEFORE IT

397

00:20:05,737 --> 00:20:17,082

EVOLVED.

398

00:20:17,149 --> 00:20:19,184

WITH PLANET ROTATION, THERE WAS

399

00:20:19,251 --> 00:20:22,454

A MAGNETIC FIELD, AND THEN

400

00:20:22,521 --> 00:20:25,724

URANIS AND NEPTUNE WE FOUND THAT

401  
00:20:25,791 --> 00:20:28,560  
THE MAGNETIC PULL WAS NEARER THE

402  
00:20:28,627 --> 00:20:31,263  
EQUATOR.

403  
00:20:31,330 --> 00:20:32,631  
SUDDENLY FROM EARTH WHAT

404  
00:20:32,698 --> 00:20:34,166  
MAGNETIC FIELDS WERE LIKE HAD TO

405  
00:20:34,232 --> 00:20:36,034  
BE GREATLY EXPANDED.

406  
00:20:36,101 --> 00:20:39,738  
THEN FOLLOWING THAT WAS ANOTHER

407  
00:20:39,805 --> 00:20:43,008  
MOON SMALLER THAN OUR MOON,

408  
00:20:43,075 --> 00:20:46,478  
COLDER, 390 DEGREES BELOW

409  
00:20:46,545 --> 00:20:49,081  
FAHRENHEIT, AND SO COLD THAT THE

410  
00:20:49,147 --> 00:20:53,151  
NITROGEN IS FROZEN INTO AN ICY

411  
00:20:53,218 --> 00:20:56,054  
POLAR CAP.

412  
00:20:56,121 --> 00:20:58,023  
THE DARK STREAKS ARE GEYSERS

413  
00:20:58,090 --> 00:21:00,425

ERUPTERS AND THERE ARE TWO

414

00:21:00,492 --> 00:21:02,594

ACTIVE GEYSERS AT THE TIME WE

415

00:21:02,661 --> 00:21:04,496

FLEW BY ON A WORLD SO COLD THAT

416

00:21:04,563 --> 00:21:08,133

EVEN NITROGEN WAS FROZEN.

417

00:21:08,200 --> 00:21:09,935

SO VOYAGER CAUSED US TO GREATLY

418

00:21:10,002 --> 00:21:11,937

EXPAND WHAT WE THOUGHT WE KNEW

419

00:21:12,004 --> 00:21:13,505

ABOUT PLANETS AND WHAT WE

420

00:21:13,572 --> 00:21:15,273

THOUGHT WE KNEW ABOUT RINGS, AND

421

00:21:15,340 --> 00:21:19,077

WHAT WE THOUGHT ABOUT MAGNETIC

422

00:21:19,144 --> 00:21:21,546

FIELDS, AND WHAT WE THOUGHT NEX.

423

00:21:21,613 --> 00:21:25,817

IN THE EARLY 1970s, IF YOU I'LL E

424

00:21:25,884 --> 00:21:27,619

QUESTIONTUNE, THE

425

00:21:27,686 --> 00:21:30,522

ANSWER WAS A FEW DECADES.

426  
00:21:30,589 --> 00:21:32,324  
HOW WAS THIS MISSION POSSIBLE IN

427  
00:21:32,391 --> 00:21:34,226  
THE SPAN OF A DOZEN YEARS.

428  
00:21:34,292 --> 00:21:36,728  
>> THE KEY IS TO USE FREE

429  
00:21:36,795 --> 00:21:37,462  
ENERGY.

430  
00:21:37,529 --> 00:21:39,564  
WE'RE NOT USING ROCKETS, WE'RE

431  
00:21:39,631 --> 00:21:42,300  
USING FREE ENERGY, WHICH WE'LL

432  
00:21:42,367 --> 00:21:43,001  
EXPLAIN.

433  
00:21:43,068 --> 00:21:46,371  
WE'LL PUT THE FIRST SLIDE UP.

434  
00:21:46,438 --> 00:21:50,509  
FIRST SLIDE, OKAY, THIS IS

435  
00:21:50,575 --> 00:21:54,312  
ACTUALLY THE RESULT OF THOUSANDS

436  
00:21:54,379 --> 00:21:55,213  
OF CALCULATIONS.

437  
00:21:55,280 --> 00:21:56,882  
I HAD TO RUN THOUSANDS AND

438  
00:21:56,948 --> 00:21:59,618

THOUSANDS OF MIRACLE

439

00:21:59,685 --> 00:22:01,219

CALCULATIONS AND TRAJECTORIES

440

00:22:01,286 --> 00:22:03,321

LOOKING FOR POSSIBLE OUTER

441

00:22:03,388 --> 00:22:03,922

PLANET MISSION.

442

00:22:03,989 --> 00:22:05,123

THIS WAS MY FAVORITE HERE IN THE

443

00:22:05,190 --> 00:22:08,593

FIRST ONE THAT WAS PUBLISHED

444

00:22:08,660 --> 00:22:10,195

SHOWING 1978 LAUNCH FROM THE

445

00:22:10,262 --> 00:22:10,762

EARTH.

446

00:22:10,829 --> 00:22:12,197

I PUT THIS UP SO YOU COULD GET

447

00:22:12,264 --> 00:22:14,366

SOME IDEA ABOUT THE ANGLES THAT

448

00:22:14,433 --> 00:22:17,803

YOU HAVE TO DEFLECT THE

449

00:22:17,869 --> 00:22:19,104

TRAJECTORY THROUGH TO GAIN

450

00:22:19,171 --> 00:22:19,438

ENERGY.

451  
00:22:19,504 --> 00:22:21,940  
SO I START WITH THE EARTH FROM

452  
00:22:22,007 --> 00:22:23,742  
SEPTEMBER 1978 THAT TINY DASH

453  
00:22:23,809 --> 00:22:24,242  
LINE.

454  
00:22:24,309 --> 00:22:27,112  
AND MAKING 135-DEGREE TURN OVER

455  
00:22:27,179 --> 00:22:28,747  
TO JUPITER, AND HERE'S NOW WHERE

456  
00:22:28,814 --> 00:22:30,248  
WE START BEGINNING ENERGY.

457  
00:22:30,315 --> 00:22:32,451  
IF WE DIDN'T DO ANYTHING I WOULD

458  
00:22:32,517 --> 00:22:35,020  
COME RIGHT BACK TO THE EARTH,

459  
00:22:35,087 --> 00:22:35,687  
BASICALLY.

460  
00:22:35,754 --> 00:22:38,957  
NOW WHEN I GO PAST JUPITER, I

461  
00:22:39,024 --> 00:22:43,729  
GET A TREMENDOUS SLINGSHOT

462  
00:22:43,795 --> 00:22:44,396  
EFFECT.

463  
00:22:44,463 --> 00:22:46,465

JUPITER IS PULLING ALONG, AND

464

00:22:46,531 --> 00:22:47,499

ADDS A TREMENDOUS BOOST OF

465

00:22:47,566 --> 00:22:47,833

ENERGY.

466

00:22:47,899 --> 00:22:49,301

I USED TO LIKE TO TELL MY

467

00:22:49,367 --> 00:22:51,236

STUDENTS IF I TOOK A SPACECRAFT

468

00:22:51,303 --> 00:22:53,905

THE SIZE OF THE VOYAGER ABOUT A

469

00:22:53,972 --> 00:22:55,807

VOLKSWAGEN SIZE, THAT'S

470

00:22:55,874 --> 00:23:01,379

EQUIVALENT TO ABOUT FOUR SATURN

471

00:23:01,446 --> 00:23:03,014

FIVE ROCKETS.

472

00:23:03,081 --> 00:23:04,282

YOU CAN HOOK THEM UP AND GET A

473

00:23:04,349 --> 00:23:05,450

TREMENDOUS BOOST IN SPEED.

474

00:23:05,517 --> 00:23:07,419

NOW IT'S NEVER GOING TO COME

475

00:23:07,486 --> 00:23:07,986

BACK.

476  
00:23:08,053 --> 00:23:10,355  
IT'S IN A HYPERBOLIC ORBIT NOW.

477  
00:23:10,422 --> 00:23:13,225  
IT IS OVER THERE TO SATURN, YOU

478  
00:23:13,291 --> 00:23:15,193  
CAN ASK ME IN A MINUTE WHERE I

479  
00:23:15,260 --> 00:23:16,128  
FIGURED THIS OUT.

480  
00:23:16,194 --> 00:23:16,995  
I CAN SHOW YOU.

481  
00:23:17,062 --> 00:23:19,931  
WE GET TO SATURN, AND IN 1978,

482  
00:23:19,998 --> 00:23:21,600  
AND I LOVE THIS ONE BECAUSE I

483  
00:23:21,666 --> 00:23:22,768  
COULD GET SO FAST.

484  
00:23:22,834 --> 00:23:25,103  
I COULD GET CLEAR OUT TO NEPTUNE

485  
00:23:25,170 --> 00:23:26,338  
IN SEVEN AND A HALF YEARS.

486  
00:23:26,404 --> 00:23:29,608  
TO DO IT YOU SEE WHAT SATURN

487  
00:23:29,674 --> 00:23:31,143  
SEES WITH LITTLE RINGS THERE.

488  
00:23:31,209 --> 00:23:33,979

I HAD TO GO BETWEEN THE PLANET

489

00:23:34,045 --> 00:23:35,914

AND THE RINGS, WHICH FOR SOME

490

00:23:35,981 --> 00:23:36,915

THAT SCARES PEOPLE.

491

00:23:36,982 --> 00:23:40,385

ALTHOUGH CASSINI HAS BEEN DOING

492

00:23:40,452 --> 00:23:40,952

THAT.

493

00:23:41,019 --> 00:23:43,622

YOU CAN GET A HUGE BOOST AND GET

494

00:23:43,688 --> 00:23:46,825

TO URANIS REALLY QUICKLY AND

495

00:23:46,892 --> 00:23:48,827

THEN NEPTUNE, AND THEN OUT OF

496

00:23:48,894 --> 00:23:50,829

THE SOLAR SYSTEM, AND THAT'S

497

00:23:50,896 --> 00:23:53,498

WHERE WE GO INTERSTELLAR AT THAT

498

00:23:53,565 --> 00:23:54,199

POINT.

499

00:23:54,266 --> 00:23:55,667

HOW COULD WE EVER SELL THIS?

500

00:23:55,734 --> 00:23:58,637

BUT THE KEY TO SELLING IT IS TO

501  
00:23:58,703 --> 00:24:01,640  
NOTICE THAT SOME IMPORTANT EVENT

502  
00:24:01,706 --> 00:24:04,843  
HAPPENS WITHIN A FOUR-YEAR TIME

503  
00:24:04,910 --> 00:24:05,143  
SPAN.

504  
00:24:05,210 --> 00:24:06,378  
IF IT DOESN'T, THEN YOU NEVER

505  
00:24:06,444 --> 00:24:08,814  
GET ANY MONEY FROM THE

506  
00:24:08,880 --> 00:24:09,581  
GOVERNMENT.

507  
00:24:09,648 --> 00:24:10,215  
THAT'S WHAT MADE IT WORK.

508  
00:24:10,282 --> 00:24:12,184  
LET ME SHOW YOU HOW WE FOUND IT.

509  
00:24:12,250 --> 00:24:14,319  
LET'S GO ON TO THE NEXT SLIDE.

510  
00:24:14,386 --> 00:24:16,087  
THE NEXT SLIDE SHOWS THE ACTUAL

511  
00:24:16,154 --> 00:24:17,722  
THING THAT I USE TO FIGURE OUT

512  
00:24:17,789 --> 00:24:19,124  
THAT YOU COULD DO IT.

513  
00:24:19,191 --> 00:24:20,859

ALONG THE BOTTOM ARE THE DATES.

514

00:24:20,926 --> 00:24:23,628

I WAS LOOKING FOR THE NEXT 10 OR

515

00:24:23,695 --> 00:24:25,697

20 YEARS FROM WHEN I WAS WORKING

516

00:24:25,764 --> 00:24:26,464

IN 1965.

517

00:24:26,531 --> 00:24:30,602

ON THE TOP--ON THE OTHER

518

00:24:30,669 --> 00:24:31,837

AXIS--VERTICAL AXIS, THESE ARE

519

00:24:31,903 --> 00:24:33,872

THE ANGLES THAT I WAS SHOWING

520

00:24:33,939 --> 00:24:35,240

YOU FROM THAT LAST SLIDE.

521

00:24:35,307 --> 00:24:37,309

I COULD SEE SOMETHING REALLY

522

00:24:37,375 --> 00:24:38,443

REMARKABLE HERE.

523

00:24:38,510 --> 00:24:41,246

IN THE 1980s OR SO, ALL OF THE

524

00:24:41,313 --> 00:24:42,848

TRACKS OF THE OUTER PLANET

525

00:24:42,914 --> 00:24:44,316

CROSSED SO THAT THE PLANETS WERE

526  
00:24:44,382 --> 00:24:45,884  
ALL ON THE SAME SIDE.

527  
00:24:45,951 --> 00:24:48,220  
OH MY GOSH, I BETTER LOOK THERE.

528  
00:24:48,286 --> 00:24:51,656  
THAT MEANS YOU COULD PROBABLY

529  
00:24:51,723 --> 00:24:52,791  
GET ONE SPACECRAFT THAT COULD

530  
00:24:52,858 --> 00:24:54,326  
HIT ALL THOSE PLANETS, WHICH IS

531  
00:24:54,392 --> 00:24:55,193  
WHAT HAPPENED.

532  
00:24:55,260 --> 00:24:57,295  
THAT'S HOW IT WAS DISCOVERED.

533  
00:24:57,362 --> 00:24:58,864  
AND THEN THE HARD WORK STARTS.

534  
00:24:58,930 --> 00:25:01,233  
YOU HAVE TO RUN ALL THESE

535  
00:25:01,299 --> 00:25:03,235  
TRAJECTORIES TO FIND THE BEST

536  
00:25:03,301 --> 00:25:04,202  
LAUNCH WINDOWS.

537  
00:25:04,269 --> 00:25:07,572  
THE ANSWER THERE WAS 1977 AND

538  
00:25:07,639 --> 00:25:08,340

1978.

539

00:25:08,406 --> 00:25:11,810

THE REAL PROBLEM HERE IS THAT IT

540

00:25:11,877 --> 00:25:13,378

RECURS EVERY 175 YEARS.

541

00:25:13,445 --> 00:25:15,347

IF YOU MISSED THIS ONE, YOU'VE

542

00:25:15,413 --> 00:25:17,449

LOST IT BECAUSE IT TAKES TIME TO

543

00:25:17,515 --> 00:25:18,450

BUILD A SPACECRAFT.

544

00:25:18,516 --> 00:25:19,417

WE HAD TEN YEARS TO DO IT.

545

00:25:19,484 --> 00:25:21,853

THE LAST TIME THIS OPPORTUNITY

546

00:25:21,920 --> 00:25:24,422

CAME WAS WHEN THOMAS JEFFERSON

547

00:25:24,489 --> 00:25:29,194

WAS PRESIDENT, AND HE MUFFED IT.

548

00:25:29,261 --> 00:25:29,895

[LAUGHTER]

549

00:25:29,961 --> 00:25:30,862

>> YOU'VE ALREADY ANTICIPATED

550

00:25:30,929 --> 00:25:32,030

ONE OF THE OTHER QUESTIONS.

551  
00:25:32,097 --> 00:25:35,300  
LET ME ASK YOU, IF THE FIRST

552  
00:25:35,367 --> 00:25:39,504  
SUCCESSFUL GRAVITY ASSIST WAS

553  
00:25:39,571 --> 00:25:41,006  
1974 WAS MARINER 10, HOW DID YOU

554  
00:25:41,072 --> 00:25:42,674  
KNOW THAT THIS WOULD WORK?

555  
00:25:42,741 --> 00:25:43,975  
WHAT OTHER PROBLEMS DID YOU

556  
00:25:44,042 --> 00:25:45,176  
THINK MIGHT HAPPEN?

557  
00:25:45,243 --> 00:25:46,745  
>> I KNEW IT WOULD WORK BECAUSE

558  
00:25:46,811 --> 00:25:48,179  
ASTRONOMERS HAVE KNOWN ABOUT IT

559  
00:25:48,246 --> 00:25:50,181  
SINCE THE 1700s, AND A LOT OF

560  
00:25:50,248 --> 00:25:53,018  
PEOPLE SINCE THEN HAVE--IF YOU

561  
00:25:53,084 --> 00:25:55,921  
FLY PAST A PLANET YOU'LL GAIN OR

562  
00:25:55,987 --> 00:25:58,390  
LOSE ENERGY DEPENDING ON WHICH

563  
00:25:58,456 --> 00:25:59,424

WAY YOU PASS.

564

00:25:59,491 --> 00:26:01,559

SO I KNEW IT WOULD WORK.

565

00:26:01,626 --> 00:26:03,395

WE DEPUTY STRAIGHTED THAT WITH

566

00:26:03,461 --> 00:26:08,600

THE MARINER EARTH VENUS MERCURY

567

00:26:08,667 --> 00:26:09,467

TRAJECTORY.

568

00:26:09,534 --> 00:26:11,503

WE KNEW THAT IT WOULD WORK.

569

00:26:11,569 --> 00:26:12,437

NO PROBLEM.

570

00:26:12,504 --> 00:26:15,006

JUST GETTING THE MONEY WAS THE

571

00:26:15,073 --> 00:26:16,107

HARD PART.

572

00:26:16,174 --> 00:26:18,877

>> WE'LL MOVE ONTO DR. CUMMINGS.

573

00:26:18,944 --> 00:26:20,679

DR. CUMMINGS, TELL US HOW YOU

574

00:26:20,745 --> 00:26:23,715

FIRST GOT INVOLVED WITH VOYAGER.

575

00:26:23,782 --> 00:26:25,984

>> ACTUALLY, I GOT INVOLVED IN

576

00:26:26,051 --> 00:26:27,585

VOYAGER BECAUSE I LOST THE

577

00:26:27,652 --> 00:26:28,887

EXPERIMENT I HAD BEEN WORKING

578

00:26:28,954 --> 00:26:29,454

ON.

579

00:26:29,521 --> 00:26:30,789

IT WENT MISSING IN

580

00:26:30,855 --> 00:26:31,556

ACTION--SERIOUSLY.

581

00:26:31,623 --> 00:26:34,092

WHAT HAPPENS WAS I WAS IN CANADA

582

00:26:34,159 --> 00:26:36,795

IN 1973, THE SUMMER OF '73, AND

583

00:26:36,861 --> 00:26:38,096

I WAS DOING WHAT WE HAD BEEN

584

00:26:38,163 --> 00:26:39,564

DOING FOR YEARS, WHICH IS ATTACH

585

00:26:39,631 --> 00:26:41,766

OUR EXPERT TO THE BOTTOM OF A

586

00:26:41,833 --> 00:26:43,635

HUGE BALLOON, SENT IT TO THE TOP

587

00:26:43,702 --> 00:26:46,571

OF THE ATMOSPHERE, WHERE WE TOOK

588

00:26:46,638 --> 00:26:47,939

OUR MEASUREMENTS.

589

00:26:48,006 --> 00:26:52,444

THE IDEA WAS THAT IT WOULD DRIFT

590

00:26:52,510 --> 00:26:56,247

WEST 500 MILES DURING THE COURSE

591

00:26:56,314 --> 00:26:58,049

OF THE DAY, THEN YOU WOULD BRING

592

00:26:58,116 --> 00:26:59,417

IT DOWN AND START ALL OVER

593

00:26:59,484 --> 00:26:59,985

AGAIN.

594

00:27:00,051 --> 00:27:01,486

BUT THE COMMAND TO CUT IT DOWN

595

00:27:01,553 --> 00:27:04,823

DIDN'T WORK, AND THE BACKUP

596

00:27:04,889 --> 00:27:06,591

CUT-DOWN TIMER DIDN'T WORK, AND

597

00:27:06,658 --> 00:27:07,659

WE KEPT GOING.

598

00:27:07,726 --> 00:27:08,927

IT WENT AROUND THE WORLD.

599

00:27:08,994 --> 00:27:10,628

IT WENT AROUND THE WORLD TWICE.

600

00:27:10,695 --> 00:27:12,931

ONE AND A HALF TIMES BECAUSE THE

601  
00:27:12,998 --> 00:27:14,399  
SECOND TIME OVER RUSSIA, THEY

602  
00:27:14,466 --> 00:27:16,334  
NOTICED IT AND THEY GOT IT.

603  
00:27:16,401 --> 00:27:18,236  
SO THAT ENDED THAT EXPERIMENT.

604  
00:27:18,303 --> 00:27:21,373  
I GOT BACK TO CAL TECH ALL

605  
00:27:21,439 --> 00:27:21,940  
DEJECTED.

606  
00:27:22,007 --> 00:27:23,308  
THEY SAID WELL, HOW WOULD YOU

607  
00:27:23,375 --> 00:27:26,711  
LIKE TO START WORKING ON A NEW

608  
00:27:26,778 --> 00:27:29,948  
PROJECT CALLED MJS 77, WHICH WAS

609  
00:27:30,015 --> 00:27:31,783  
THE EARLY NAME FOR VOYAGER.

610  
00:27:31,850 --> 00:27:33,251  
I SAID OKAY.

611  
00:27:33,318 --> 00:27:34,552  
THE REST IS HISTORY.

612  
00:27:34,619 --> 00:27:35,920  
I'VE BEEN WORKING ON IT EVER

613  
00:27:35,987 --> 00:27:36,821

SINCE.

614

00:27:36,888 --> 00:27:39,524

NOW LOOKING BACK ON 1973 AND

615

00:27:39,591 --> 00:27:41,059

LOSING THAT BALLOON, IT WAS NOT

616

00:27:41,126 --> 00:27:41,893

ALL THAT BAD.

617

00:27:41,960 --> 00:27:43,528

I GOT TO START WORKING ON THE

618

00:27:43,595 --> 00:27:45,063

GREATEST MISSION EVER, REALLY.

619

00:27:45,130 --> 00:27:46,765

>> SO YOU WERE PUT IN THE RIGHT

620

00:27:46,831 --> 00:27:49,134

PLACE AT THE RIGHT TIME WITH

621

00:27:49,200 --> 00:27:50,301

IDLE HANDS.

622

00:27:50,368 --> 00:27:50,969

>> YES.

623

00:27:51,036 --> 00:27:52,070

>> TELL ME ABOUT YOUR

624

00:27:52,137 --> 00:27:53,304

EXPERIENCES WITH VOYAGER.

625

00:27:53,371 --> 00:27:55,306

WHAT ARE SOME OF YOUR MEMORIES?

626  
00:27:55,373 --> 00:27:56,674  
>> WELL, RIGHT OFF THE BAT, ONE

627  
00:27:56,741 --> 00:27:58,343  
OF THE EARLY ONES I THINK I WAS

628  
00:27:58,410 --> 00:28:00,345  
THE LAST PERSON TO PHYSICALLY

629  
00:28:00,412 --> 00:28:02,680  
TOUCH THE SPACECRAFT.

630  
00:28:02,747 --> 00:28:04,549  
RIGHT DURING THE LAST STEP OF

631  
00:28:04,616 --> 00:28:07,252  
THE CAPSULATION OF THE

632  
00:28:07,318 --> 00:28:10,221  
SPACECRAFT WE WERE WORRIED ABOUT

633  
00:28:10,288 --> 00:28:11,790  
OUR FRAGILE WINDOWS ON OUR

634  
00:28:11,856 --> 00:28:12,557  
INSTRUMENTS.

635  
00:28:12,624 --> 00:28:16,194  
I WAS ALLOWED TO CRAWL UP IN

636  
00:28:16,261 --> 00:28:17,162  
THERE AND INSPECT THEM.

637  
00:28:17,228 --> 00:28:19,030  
AND MAKE SURE THAT THE WINDOWS

638  
00:28:19,097 --> 00:28:20,999

WERE TIGHT ON THE TELESCOPES.

639

00:28:21,066 --> 00:28:23,001

SO I GAVE EACH ONE A LITTLE

640

00:28:23,068 --> 00:28:23,501

TWIST.

641

00:28:23,568 --> 00:28:25,737

SO IT IS EERIE TO THINK IF I WAS

642

00:28:25,804 --> 00:28:27,539

THE LAST PERSON TO TOUCH THEM,

643

00:28:27,605 --> 00:28:29,274

THE NEXT PERSON TO TOUCH THEM IS

644

00:28:29,340 --> 00:28:33,278

GOING TO BE A SPACE ALIEN.

645

00:28:33,344 --> 00:28:34,012

[ CHUCKLING ]

646

00:28:34,079 --> 00:28:35,447

ANOTHER THING, AND BRING UP THIS

647

00:28:35,513 --> 00:28:36,514

SLIDE HERE, YES.

648

00:28:36,581 --> 00:28:41,419

THIS IS A PICTURE OF OUR COSMIC

649

00:28:41,486 --> 00:28:44,522

TEAM LOOKING AT OUR FIRST DATA

650

00:28:44,589 --> 00:28:46,324

IN 1977 FROM VOYAGER 2.

651  
00:28:46,391 --> 00:28:51,930  
I'M THE ONE BENT OVER.

652  
00:28:51,996 --> 00:28:54,599  
I WAS THE ONLY ONE, APPARENTLY,

653  
00:28:54,666 --> 00:28:56,167  
WHO COULD RAID THE DATA UPSIDE

654  
00:28:56,234 --> 00:28:56,734  
DOWN.

655  
00:28:56,801 --> 00:28:58,837  
BUT AT THE TIME THIS PICTURE WAS

656  
00:28:58,903 --> 00:29:00,472  
TAKEN WE WERE NOT CONVINCED THAT

657  
00:29:00,538 --> 00:29:02,307  
THIS INSTRUMENT WAS WORKING, BUT

658  
00:29:02,373 --> 00:29:04,509  
IT WAS AND IT HAS BEEN FOR 40

659  
00:29:04,576 --> 00:29:05,243  
YEARS IN SPACE.

660  
00:29:05,310 --> 00:29:12,817  
BUT FOR ME, COSMIC PHYSICIST,

661  
00:29:12,884 --> 00:29:15,553  
THIS WAS THE HOLY GRAIL IN MY

662  
00:29:15,620 --> 00:29:16,121  
AREA OF RESEARCH.

663  
00:29:16,187 --> 00:29:18,323

THAT'S THE FIRST TIME YOU COULD

664

00:29:18,389 --> 00:29:23,027

MEASURE THE LOW PART OF THE

665

00:29:23,094 --> 00:29:24,162

COSMIC RAY DISTRIBUTION.

666

00:29:24,229 --> 00:29:26,998

THOSE PARTICLES ARE NOT

667

00:29:27,065 --> 00:29:30,268

DETECTABLE IN THE SPHERE, YOU

668

00:29:30,335 --> 00:29:31,970

COULD ONLY DO THAT WHEN YOU'RE

669

00:29:32,036 --> 00:29:34,005

THERE.

670

00:29:34,072 --> 00:29:35,473

AND ONE OF THE REASONS IS THAT

671

00:29:35,540 --> 00:29:38,543

THE RACE ARE A HAZARD TO

672

00:29:38,610 --> 00:29:40,545

ASTRONAUTS ON LONG DURATION

673

00:29:40,612 --> 00:29:41,112

MISSION.

674

00:29:41,179 --> 00:29:42,313

NOW WE KNOW THAT THE SUN GOES

675

00:29:42,380 --> 00:29:45,049

QUIET FOR A CERTAIN PERIOD, AND

676  
00:29:45,116 --> 00:29:52,590  
WHAT IS THE MAXIMUM THAT THE

677  
00:29:52,657 --> 00:29:53,691  
ASTRONAUTS WOULD HAVE TO DEAL

678  
00:29:53,758 --> 00:29:54,025  
WITH.

679  
00:29:54,092 --> 00:29:56,327  
>> HOW DO WE KNOW THAT VOYAGER

680  
00:29:56,394 --> 00:29:58,496  
IS STILL OUT IN STELLAR SPACE?

681  
00:29:58,563 --> 00:29:59,998  
>> THAT TOOK AWHILE TO FIGURE

682  
00:30:00,064 --> 00:30:01,032  
OUT, ACTUALLY.

683  
00:30:01,099 --> 00:30:04,369  
FROM OUR DATA, THE WAY THEY

684  
00:30:04,435 --> 00:30:08,273  
BEHAVED, YES, WE'RE ENTERING

685  
00:30:08,339 --> 00:30:10,074  
INTERSTELLAR SPACE IN 2012.

686  
00:30:10,141 --> 00:30:13,678  
BUT THEN THEY SAID THE MAGNETIC

687  
00:30:13,745 --> 00:30:14,412  
FIELD DIRECTION DIDN'T CHANGE AT

688  
00:30:14,479 --> 00:30:14,679

ALL.

689

00:30:14,746 --> 00:30:16,681

THAT WOULD MEAN THAT THE SUN'S

690

00:30:16,748 --> 00:30:19,551

MAGNETIC FIELD AND THE GALAXY'S

691

00:30:19,617 --> 00:30:20,752

MAGNETIC FIELD WERE LINED UP,

692

00:30:20,818 --> 00:30:23,288

AND THAT DIDN'T SEEM LIKELY.

693

00:30:23,354 --> 00:30:26,024

THEN THE PLASMA WAVE TEAM CAME

694

00:30:26,090 --> 00:30:26,724

TO THE RESCUE.

695

00:30:26,791 --> 00:30:29,527

LET ME SHOW IT TO YOU IN A

696

00:30:29,594 --> 00:30:30,995

MINUTE.

697

00:30:31,062 --> 00:30:33,932

ANYWAY, THE SUN SENT OUT SOME

698

00:30:33,998 --> 00:30:36,734

BIG BLAST WAVES, AND THEY

699

00:30:36,801 --> 00:30:39,103

REACHED THE VICINITY OF VOYAGER

700

00:30:39,170 --> 00:30:41,239

ONE.

701  
00:30:41,306 --> 00:30:44,108  
AND THE PLASMA WAVE MEASURED THE

702  
00:30:44,175 --> 00:30:46,010  
FREQUENCY OF THOSE OSCILLATIONS.

703  
00:30:46,077 --> 00:30:47,812  
IF YOU KNOW THE FREQUENCY OF

704  
00:30:47,879 --> 00:30:48,980  
THOSE OSCILLATIONS.

705  
00:30:49,047 --> 00:30:52,317  
THEN YOU KNOW THE DENSITY OF THE

706  
00:30:52,383 --> 00:30:52,917  
PLASMA.

707  
00:30:52,984 --> 00:30:56,487  
THESE COLORED SPLOTCHES ARE

708  
00:30:56,554 --> 00:30:57,188  
REPRESENTATIVE OF THE

709  
00:30:57,255 --> 00:30:57,622  
OSCILLATION.

710  
00:30:57,689 --> 00:30:59,958  
AND TURNS OUT THAT THE DENSITY

711  
00:31:00,024 --> 00:31:02,260  
IS EXPECTED IN INTERSTELLAR

712  
00:31:02,327 --> 00:31:05,430  
SPACE AND NOT INSIDE THE HELIO

713  
00:31:05,496 --> 00:31:05,930

POD.

714

00:31:05,997 --> 00:31:08,533

THAT'S WHEN WE KNEW THAT VOYAGER

715

00:31:08,600 --> 00:31:10,368

ONE HAD GONE INTERSTELLAR.

716

00:31:10,435 --> 00:31:13,838

BY THE WAY, THEY'RE COMING TO

717

00:31:13,905 --> 00:31:15,406

GRIPS WITH THE DATA AND FIGURING

718

00:31:15,473 --> 00:31:17,775

OUT THAT WHY THAT HAPPENED, AND

719

00:31:17,842 --> 00:31:21,279

IT'S JUST INTERACTION BETWEEN

720

00:31:21,346 --> 00:31:26,084

SPHERES IS A LITTLE MORE

721

00:31:26,150 --> 00:31:28,720

COMPLICATED THAN WE FIRST

722

00:31:28,786 --> 00:31:30,188

THOUGHT.

723

00:31:30,255 --> 00:31:31,856

>> DR. DODD, MAYBE WE CAN ASK

724

00:31:31,923 --> 00:31:34,459

YOU WHERE ARE THE FIRST GRAPHIC.

725

00:31:34,525 --> 00:31:37,161

I WOULD LIKE TO SAY THE JOY OF

726  
00:31:37,228 --> 00:31:38,830  
TWO SPACECRAFTS, YOU HAVE TO

727  
00:31:38,896 --> 00:31:41,733  
HAVE A MODEL THAT FITS BOTH DATA

728  
00:31:41,799 --> 00:31:42,500  
POINTS.

729  
00:31:42,567 --> 00:31:44,969  
SO WE HAVE TWO SPACE CRAFTS THAT

730  
00:31:45,036 --> 00:31:46,037  
ARE IDENTICAL.

731  
00:31:46,104 --> 00:31:47,705  
VOYAGER 1 IS THE ONE WHERE YOU

732  
00:31:47,772 --> 00:31:50,041  
LOOK ON THIS GRAPHIC IT IS GOING

733  
00:31:50,108 --> 00:31:51,476  
UP AND OUT.

734  
00:31:51,542 --> 00:31:55,246  
IT IS IN INTERSTELLAR SPACE AS

735  
00:31:55,313 --> 00:31:58,549  
OF AUGUST 25, 2012.

736  
00:31:58,616 --> 00:32:00,018  
VOYAGER 2 IS GOING DOWN AND OUT

737  
00:32:00,084 --> 00:32:02,787  
AND HAS YET TO CROSS THE

738  
00:32:02,854 --> 00:32:04,055

## BOUNDARY INTO INTERSTELLAR

739

00:32:04,122 --> 00:32:04,355  
SPACE.

740

00:32:04,422 --> 00:32:05,089  
THAT'S PROBABLY THE NUMBER ONE

741

00:32:05,156 --> 00:32:07,859  
QUESTION THAT ANYBODY WHO WORKS

742

00:32:07,925 --> 00:32:11,963  
ON THE PROJECT GETS.

743

00:32:12,030 --> 00:32:15,733  
SO VOYAGER 1 WAS ACTUALLY

744

00:32:15,800 --> 00:32:17,602  
LAUNCHED SECOND, BUT IT IS

745

00:32:17,669 --> 00:32:18,703  
TRAVELING THE FASTEST.

746

00:32:18,770 --> 00:32:21,272  
IT IS THE FURTHEST SPACECRAFT

747

00:32:21,339 --> 00:32:25,510  
FROM US AT 13 BILLION MILES AND

748

00:32:25,576 --> 00:32:26,644  
TRAVELS 38,000 MILES AN HOUR

749

00:32:26,711 --> 00:32:27,211  
APPROXIMATELY.

750

00:32:27,278 --> 00:32:29,247  
NOTHING IS GOING TO CATCH UP TO

751  
00:32:29,314 --> 00:32:29,847  
IT.

752  
00:32:29,914 --> 00:32:31,316  
AND VOYAGER 2 IS TRAVELING A

753  
00:32:31,382 --> 00:32:36,020  
LITTLE BIT SLOWER, 34,000 MPH

754  
00:32:36,087 --> 00:32:37,088  
APPROXIMATELY, 40 TIMES THE

755  
00:32:37,155 --> 00:32:42,493  
SPEED OF SOUND HERE ON EARTH.

756  
00:32:42,560 --> 00:32:45,730  
>> SO, MOVING THAT SO FAR AWAY

757  
00:32:45,797 --> 00:32:49,067  
HOW DO WE COMMUNICATE WITH THESE

758  
00:32:49,133 --> 00:32:49,801  
SPACECRAFTS?

759  
00:32:49,867 --> 00:32:50,635  
>> BECAUSE VOYAGERS ARE SO FAR

760  
00:32:50,702 --> 00:32:52,637  
AWAY THEY NEED TO USE THE DEEP

761  
00:32:52,704 --> 00:32:57,041  
SPACE NETWORK ANTENNAS, WHICH IS

762  
00:32:57,108 --> 00:32:59,310  
LARGE ARRAY.

763  
00:32:59,377 --> 00:33:01,579

THEY'RE 70-METER ANTENNA AND

764

00:33:01,646 --> 00:33:05,149

THEY'RE LOCATED IN AUSTRALIA, IN

765

00:33:05,216 --> 00:33:07,452

SPAIN, AND HERE IN

766

00:33:07,518 --> 00:33:08,786

CALIFORNIA--I'M NOT IN

767

00:33:08,853 --> 00:33:10,054

CALIFORNIA NOW.

768

00:33:10,121 --> 00:33:13,991

BUT BACK HOME IN CALIFORNIA.

769

00:33:14,058 --> 00:33:17,495

AND SO THE WAY VOYAGER OPERATES

770

00:33:17,562 --> 00:33:18,563

IS SLIGHTLY DIFFERENT THAN OTHER

771

00:33:18,629 --> 00:33:19,364

MISSIONS IN THE SENSE THAT MOST

772

00:33:19,430 --> 00:33:21,733

OF THE DATA COMES DOWN

773

00:33:21,799 --> 00:33:23,801

CONTINUOUSLY IN REALTIME, AND

774

00:33:23,868 --> 00:33:25,169

SENT DOWN TO THE EARTH.

775

00:33:25,236 --> 00:33:27,405

AND WE CAPTURE THE DATA WITH THE

776

00:33:27,472 --> 00:33:29,340

SPACE NETWORK AND ANTENNAS.

777

00:33:29,407 --> 00:33:31,142

SO WHEN WE'RE LISTENING TO THAT

778

00:33:31,209 --> 00:33:33,111

DATA, WE CAPTURE THE DATA, AND

779

00:33:33,177 --> 00:33:37,749

WE CAPTURE DATA FROM BOTH

780

00:33:37,815 --> 00:33:40,451

SPACECRAFT FOUR TO SIX HOURS A

781

00:33:40,518 --> 00:33:42,787

DAY FROM EACH SPACECRAFT.

782

00:33:42,854 --> 00:33:44,455

WE SEND COMMANDS TO THE

783

00:33:44,522 --> 00:33:45,556

SPACECRAFT ONCE A WEEK.

784

00:33:45,623 --> 00:33:47,191

A LOT OF TIMES THOSE COMMANDS

785

00:33:47,258 --> 00:33:48,259

ARE HOW ARE YOU?

786

00:33:48,326 --> 00:33:49,827

HOW ARE YOU DOING?

787

00:33:49,894 --> 00:33:51,462

NOW, BECAUSE OF THE DISTANCE THE

788

00:33:51,529 --> 00:33:57,034

## ROUND TRIP LIFETIME FOR VOYAGER

789

00:33:57,101 --> 00:33:57,969

1 IS 38 HOURS.

790

00:33:58,035 --> 00:33:59,303

WHAT THAT MEANS IS THAT

791

00:33:59,370 --> 00:34:00,772

ENGINEERS, WE'RE IN OUR OFFICE

792

00:34:00,838 --> 00:34:01,973

ON A MONDAY AFTERNOON.

793

00:34:02,039 --> 00:34:04,242

WE TYPE A COMMAND THAT SAYS

794

00:34:04,308 --> 00:34:05,376

HELLO TO VOYAGER.

795

00:34:05,443 --> 00:34:06,444

WE SEND IT OFF.

796

00:34:06,511 --> 00:34:08,479

WE COME BACK IN THE OFFICE NOT

797

00:34:08,546 --> 00:34:10,148

TUESDAY BUT WEDNESDAY MORNING,

798

00:34:10,214 --> 00:34:11,649

AND VOYAGER SAYS, I'M FINE, HOW

799

00:34:11,716 --> 00:34:14,485

ARE YOU DOING?

800

00:34:14,552 --> 00:34:17,288

MORE THAN A DAY AND A HALF FOR

801  
00:34:17,355 --> 00:34:19,590  
ROUND TRIP FLIGHT TIME FOR

802  
00:34:19,657 --> 00:34:20,358  
VOYAGER 1.

803  
00:34:20,425 --> 00:34:22,393  
THAT HAS ITS OWN CHALLENGES IN

804  
00:34:22,460 --> 00:34:23,428  
COMMUNICATING WITH THE

805  
00:34:23,494 --> 00:34:23,895  
SPACECRAFT.

806  
00:34:23,961 --> 00:34:27,698  
>> HOW ARE THE VOYAGERS DOING?

807  
00:34:27,765 --> 00:34:30,201  
>> WELL, PULL UP THE NEXT SLIDE.

808  
00:34:30,268 --> 00:34:33,638  
THE VOYAGERS ARE HEALTHY AS

809  
00:34:33,704 --> 00:34:34,806  
SENIOR CITIZENS CAN BE.

810  
00:34:34,872 --> 00:34:36,407  
THAT'S THE WAY I LIKE TO THINK

811  
00:34:36,474 --> 00:34:37,742  
OF THEM.

812  
00:34:37,809 --> 00:34:38,976  
THEY'RE TWIN SPACECRAFT,

813  
00:34:39,043 --> 00:34:42,447

IDENTICAL AND I THINK OF THEM AS

814

00:34:42,513 --> 00:34:54,659

TWIN, SENIOR-CITIZEN SISTERS.

815

00:34:54,725 --> 00:34:57,829

VOYAGER 2 IS TONE DEAF.

816

00:34:57,895 --> 00:35:00,965

VOYAGER 1 DOES NOT HAVE AN

817

00:35:01,032 --> 00:35:04,402

ACTIVE OR OPERATING PLASMA

818

00:35:04,469 --> 00:35:05,403

SCIENCE INSTRUMENT.

819

00:35:05,470 --> 00:35:08,339

WHAT THAT MEANS IS THAT VOYAGER

820

00:35:08,406 --> 00:35:10,475

1 CANNOT DIRECTLY FEEL THE SOLAR

821

00:35:10,541 --> 00:35:12,510

WIND AND HIGHER ENERGY CHARGED

822

00:35:12,577 --> 00:35:14,445

PARTICLES COMING FROM THE SUN.

823

00:35:14,512 --> 00:35:17,381

AS ALEX EXPLAINED, IT HAD TO

824

00:35:17,448 --> 00:35:21,085

INFER THAT A DIFFERENT

825

00:35:21,152 --> 00:35:21,819

INSTRUMENT.

826

00:35:21,886 --> 00:35:24,689

EACH OF THE SPACECRAFTS HAD

827

00:35:24,755 --> 00:35:26,424

REDUNDANT SYSTEMS WHEN THEY WERE

828

00:35:26,491 --> 00:35:26,991

LAUNCHED.

829

00:35:27,058 --> 00:35:28,759

OVER TIME CERTAIN THINGS WERE

830

00:35:28,826 --> 00:35:29,527

BROKEN.

831

00:35:29,594 --> 00:35:30,962

WE'VE HAD TO GO TO THE BACKUP

832

00:35:31,028 --> 00:35:32,663

SYSTEM AND WE'VE TURNED THINGS

833

00:35:32,730 --> 00:35:33,297

OFF.

834

00:35:33,364 --> 00:35:35,500

POWER IS OUR LIMITING RESOURCE.

835

00:35:35,566 --> 00:35:39,770

WE USE ISOTOPE GENERATORS ON

836

00:35:39,837 --> 00:35:42,039

VOYAGER, THE BIG CANISTER BOOMS

837

00:35:42,106 --> 00:35:43,774

OUT HERE ON THE LEFT SIDE OF THE

838

00:35:43,841 --> 00:35:46,477

IMAGE YOU'RE SEEING.

839

00:35:46,544 --> 00:35:48,913

WE LOSE FOUR WATTS OF FOUR A

840

00:35:48,980 --> 00:35:49,514

YEAR.

841

00:35:49,580 --> 00:35:51,449

NOW GOING INTO OUR FIFTH DECADE

842

00:35:51,516 --> 00:35:52,950

OF OPERATION, THE REAL KEY IS

843

00:35:53,017 --> 00:35:55,853

HOW LONG TO MAKE THIS SPACECRAFT

844

00:35:55,920 --> 00:35:56,621

OPERATE?

845

00:35:56,687 --> 00:35:58,356

AND WHEN WE HAVE TO START

846

00:35:58,422 --> 00:36:00,157

TURNING OFF INSTRUMENTS, AND HOW

847

00:36:00,224 --> 00:36:01,092

LONG CAN WE LAST?

848

00:36:01,158 --> 00:36:03,494

AND IT'S A BALANCE BETWEEN THE

849

00:36:03,561 --> 00:36:05,897

ENGINEERING AND THE SCIENCE

850

00:36:05,963 --> 00:36:06,597

DESIRES.

851  
00:36:06,664 --> 00:36:08,332  
WE HOPE TO KEEP THIS MISSION

852  
00:36:08,399 --> 00:36:11,302  
OPERATING AND HAVE SCIENCE

853  
00:36:11,369 --> 00:36:15,973  
INSTRUMENTS OPERATING GOING INTO

854  
00:36:16,040 --> 00:36:18,442  
2025, 2026, 2027, WE'RE NOT

855  
00:36:18,509 --> 00:36:20,211  
SURE, BUT PERSONALLY I HOPE I

856  
00:36:20,278 --> 00:36:22,313  
CAN SIT HERE TEN YEARS FROM NOW

857  
00:36:22,380 --> 00:36:24,582  
AND TALK ABOUT THE

858  
00:36:24,649 --> 00:36:25,416  
50TH ANNIVERSARY OF VOYAGER

859  
00:36:25,483 --> 00:36:27,552  
LAUNCH AND STILL HAVE THEM

860  
00:36:27,618 --> 00:36:29,487  
FLYING.

861  
00:36:29,554 --> 00:36:30,488  
>> WELL, THE GOLDEN RECORD IS

862  
00:36:30,555 --> 00:36:31,923  
PROBABLY ONE OF THE MOST

863  
00:36:31,989 --> 00:36:34,191

WELL-KNOWN OBJECTS IN THE

864

00:36:34,258 --> 00:36:35,293

HISTORY OF SPACE EXPLORATION.

865

00:36:35,359 --> 00:36:37,628

WHAT CAN YOU TELL US ABOUT IT

866

00:36:37,695 --> 00:36:39,530

THAT MAYBE WE DON'T ALREADY

867

00:36:39,597 --> 00:36:40,264

KNOW?

868

00:36:40,331 --> 00:36:41,566

>> WELL, A LOT OF PEOPLE THINK

869

00:36:41,632 --> 00:36:43,467

THAT IT WAS JUST THE WHIM OF

870

00:36:43,534 --> 00:36:46,037

CARL SAGAN AND ONE OR TWO OTHER

871

00:36:46,103 --> 00:36:47,038

PEOPLE.

872

00:36:47,104 --> 00:36:51,776

BUT IN FACT, WE CONSULTED PEOPLE

873

00:36:51,842 --> 00:36:53,844

ALL OVER THE WORLD.

874

00:36:53,911 --> 00:36:56,747

SO THEY HAVE NOT GOTTEN THEIR

875

00:36:56,814 --> 00:36:58,349

JUST DUE IN TERMS OF BEAUTIFUL

876  
00:36:58,416 --> 00:37:00,017  
MUSIC THAT THEY BROUGHT TO US.

877  
00:37:00,084 --> 00:37:01,719  
MANY PEOPLE HAVE SAID IN THE

878  
00:37:01,786 --> 00:37:03,621  
DECADES SINCE THAT THE VOYAGER

879  
00:37:03,688 --> 00:37:06,090  
RECORD IS THE BEGINNING OF WORLD

880  
00:37:06,157 --> 00:37:06,691  
MUSIC.

881  
00:37:06,757 --> 00:37:11,762  
THAT IS VERY MUCH DUE TO CARL'S

882  
00:37:11,829 --> 00:37:14,532  
PLANETARY PERSPECTIVE, AND HIS

883  
00:37:14,599 --> 00:37:17,134  
DESIRE NOT JUST TO REPRESENT THE

884  
00:37:17,201 --> 00:37:19,537  
IMPERIAL CULTURE THAT CREATED

885  
00:37:19,604 --> 00:37:21,005  
THE SPACECRAFT, BUT ALL THE

886  
00:37:21,072 --> 00:37:23,541  
DIFFERENT WAYS THAT WE FOUND TO

887  
00:37:23,608 --> 00:37:26,077  
EXPRESS THE JOY IN BEING ALIVE.

888  
00:37:26,143 --> 00:37:29,780

AND SO I FOUND SOMETHING OUT

889

00:37:29,847 --> 00:37:30,815

ABOUT THE VOYAGER RECORD TWO

890

00:37:30,881 --> 00:37:32,116

DAYS AGO THAT I NEVER KNEW IN

891

00:37:32,183 --> 00:37:34,352

ALL THESE 40 YEARS, AND THAT WAS

892

00:37:34,418 --> 00:37:39,957

THERE IS A PERUVIAN WEDDING SONG

893

00:37:40,024 --> 00:37:42,426

SUNG BY A CHILD IN THE ANDES,

894

00:37:42,493 --> 00:37:46,464

WHO WAS RECORDED, AND WE NEVER

895

00:37:46,530 --> 00:37:50,034

THOUGHT TO ASK WHAT THE WORDS

896

00:37:50,101 --> 00:37:50,601

MEAN.

897

00:37:50,668 --> 00:37:52,336

WE JUST KNEW IT WAS A WEDDING

898

00:37:52,403 --> 00:37:52,937

SONG.

899

00:37:53,004 --> 00:37:56,173

AND WE JUST FOUND OUT THAT IT IS

900

00:37:56,240 --> 00:38:03,147

A SCATHING INDICTMENT OF THE

901  
00:38:03,214 --> 00:38:11,122  
MALE CHAUVINISM OF THAT CULTURE

902  
00:38:11,188 --> 00:38:13,391  
AND THE NIGHTMARE FOR WOMEN IN

903  
00:38:13,457 --> 00:38:14,225  
THAT SOCIETY.

904  
00:38:14,291 --> 00:38:15,626  
THAT WAS A REVELATION TO ME.

905  
00:38:15,693 --> 00:38:19,063  
THERE ARE SO MANY REVELATIONS

906  
00:38:19,130 --> 00:38:28,039  
HIDDEN DEEP IN THE MUSIC.

907  
00:38:28,105 --> 00:38:31,008  
AND MUSIC FROM HUMPBACK WHALES,

908  
00:38:31,075 --> 00:38:34,412  
AND THERE IS A LOT TO LEARN.

909  
00:38:34,478 --> 00:38:36,147  
>> YOU HAVE FOUND A LOT IN THE

910  
00:38:36,213 --> 00:38:36,681  
RECORD.

911  
00:38:36,747 --> 00:38:38,516  
HAVE YOU IMAGINED WHAT IT WOULD

912  
00:38:38,582 --> 00:38:43,454  
SAY TO HUMANS TO A FULLY ALIEN

913  
00:38:43,521 --> 00:38:46,791

SPECIES IF DISCOVERED.

914

00:38:46,857 --> 00:38:47,925

>> UNFORTUNATELY, EVERY NIGHT OF

915

00:38:47,992 --> 00:38:48,659

MY LIFE.

916

00:38:48,726 --> 00:38:51,295

I'M LUCKY ENOUGH TO HAVE THAT

917

00:38:51,362 --> 00:38:56,367

BEAUTIFUL COVER ETCHED WITH THE

918

00:38:56,434 --> 00:39:01,172

SCIENTIFIC HIEROGLYPHICS.

919

00:39:01,238 --> 00:39:01,672

IT'S REAL.

920

00:39:01,739 --> 00:39:04,975

THEY ARE REALLY MOVING BETWEEN

921

00:39:05,042 --> 00:39:07,311

35,000 TO 40,000 MILES AND HOUR.

922

00:39:07,378 --> 00:39:08,813

THEY ARE AS REAL AS WE ARE.

923

00:39:08,879 --> 00:39:11,515

SO TO TRY TO IMAGINE TRAVELING

924

00:39:11,582 --> 00:39:18,456

ALONG SIDE THESE SPACECRAFT AND

925

00:39:18,522 --> 00:39:22,159

THE DESIGN SPECIFICATIONS.

926  
00:39:22,226 --> 00:39:26,731  
IT HAS EXCEEDED NASA'S FONDEST,

927  
00:39:26,797 --> 00:39:28,265  
CRAZIEST DREAMS FOR IT.

928  
00:39:28,332 --> 00:39:31,602  
WHEN THEY SAY THE WRECK IS GOING

929  
00:39:31,669 --> 00:39:34,271  
TO LAST ONE TO FIVE BILLION

930  
00:39:34,338 --> 00:39:37,208  
YEARS, AND HERE WE ARE 40 YEARS

931  
00:39:37,274 --> 00:39:38,909  
LATER, IT COULD BE MORE THAN

932  
00:39:38,976 --> 00:39:39,443  
THAT.

933  
00:39:39,510 --> 00:39:41,112  
THE CHANCES ARE VERY SMALL OF IT

934  
00:39:41,178 --> 00:39:43,481  
BEING INTERCEPTED--OF EARTH OF

935  
00:39:43,547 --> 00:39:46,150  
THEM BEING INTERCEPTED, BUT I

936  
00:39:46,217 --> 00:39:49,086  
HAVE IMAGINED COUNTLESS TIMES

937  
00:39:49,153 --> 00:39:52,690  
SOME GRAD STUDENT ON SOME

938  
00:39:52,757 --> 00:39:55,426

INTERSTELLAR WHO HAS A WHOLE

939

00:39:55,493 --> 00:39:57,461

COLLECTION OF THESE ARTIFACTS

940

00:39:57,528 --> 00:40:03,300

FROM THESE ADOLESCENT TECHNOLOGY

941

00:40:03,367 --> 00:40:05,336

THAT CAN'T WAIT TO TELL THE

942

00:40:05,402 --> 00:40:10,407

COSMOS WHAT THEY CAN DO.

943

00:40:10,474 --> 00:40:13,511

LISTENING TO IT, AND ROCKING OUT

944

00:40:13,577 --> 00:40:17,548

TO MAYBE "JOHNNY BE GOOD," MAYBE

945

00:40:17,615 --> 00:40:18,983

THEY'LL THINK THESE GUYS KNEW

946

00:40:19,049 --> 00:40:20,017

HOW TO PARTY.

947

00:40:20,084 --> 00:40:21,685

>> THAT SOUNDS LIKE A BASIS OF A

948

00:40:21,752 --> 00:40:22,653

GREAT BOOK.

949

00:40:22,720 --> 00:40:24,255

WE HAVE TIME FOR A COUPLE OF

950

00:40:24,321 --> 00:40:25,790

AUDIENCE QUESTIONS.

951  
00:40:25,856 --> 00:40:28,025  
YES?

952  
00:40:28,092 --> 00:40:29,527  
>> HI, WE HAVE A LOT OF

953  
00:40:29,593 --> 00:40:30,694  
QUESTIONS ON SOCIAL MEDIA.

954  
00:40:30,761 --> 00:40:32,763  
THE FIRST ONE COMES FROM

955  
00:40:32,830 --> 00:40:33,397  
TWITTER.

956  
00:40:33,464 --> 00:40:35,800  
CAN YOU ELABORATE ON THE BRAIN

957  
00:40:35,866 --> 00:40:39,937  
WAVE EEG ON THE GOLDEN DISKS AND

958  
00:40:40,004 --> 00:40:42,006  
THE LOVE STORY INSIDE.

959  
00:40:42,072 --> 00:40:42,840  
>> WITH JOY.

960  
00:40:42,907 --> 00:40:44,041  
I WOULD BE HAPPY TO TALK ABOUT

961  
00:40:44,108 --> 00:40:50,614  
THAT.

962  
00:40:50,681 --> 00:40:53,250  
ONE DAY I ASKED CARL IF IT WAS

963  
00:40:53,317 --> 00:40:56,887

POSSIBLE IF I WERE TO MEDITATE

964

00:40:56,954 --> 00:41:00,357

AND ALL OF IMPULSES THAT MY BODY

965

00:41:00,424 --> 00:41:05,696

WAS GIVING OFF, MY EKG, MY EEG,

966

00:41:05,763 --> 00:41:09,099

EVERY REM, EVERY SINGLE THING,

967

00:41:09,166 --> 00:41:13,671

WAS IT CONCEIVABLE THAT THE

968

00:41:13,737 --> 00:41:16,807

DISTANCE TIMES COULD RECONS

969

00:41:16,874 --> 00:41:23,981

CONSTITUTE THIS MEDITATION AND

970

00:41:24,048 --> 00:41:25,616

INTERPRET IT.

971

00:41:25,683 --> 00:41:27,284

HE SAID THAT'S A LONG TIME.

972

00:41:27,351 --> 00:41:28,152

GO DO IT.

973

00:41:28,219 --> 00:41:32,122

I WENT TO THE MEDICAL CENTER.

974

00:41:32,189 --> 00:41:36,093

AND I WAS HOOKED UP TO A

975

00:41:36,160 --> 00:41:39,196

COMPUTER THAT TOOK UP A VAST

976  
00:41:39,263 --> 00:41:44,702  
ROOM THAT WAS PROBABLY MUCH MORE

977  
00:41:44,768 --> 00:41:46,403  
FEEBLE THAN OUR IPHONES.

978  
00:41:46,470 --> 00:41:49,240  
I MEDICATED FOR AN HOUR ABOUT

979  
00:41:49,306 --> 00:41:52,209  
THE HISTORY OF THE PLANET, ABOUT

980  
00:41:52,276 --> 00:41:54,345  
ITS GEOLOGY, IT'S BIOLOGY, AND

981  
00:41:54,411 --> 00:41:56,180  
IT'S EMERGING TECHNOLOGY TO THE

982  
00:41:56,247 --> 00:41:59,416  
BEST OF MY VERY LIMITED

983  
00:41:59,483 --> 00:42:00,017  
ABILITIES.

984  
00:42:00,084 --> 00:42:02,953  
IT TOLD THE STORIES OF OUR

985  
00:42:03,020 --> 00:42:04,555  
SPECIES, THE HISTORY OF OUR

986  
00:42:04,622 --> 00:42:06,257  
CIVILIZATION SINCE THE INVENTION

987  
00:42:06,323 --> 00:42:07,591  
OF AGRICULTURE.

988  
00:42:07,658 --> 00:42:09,994

THIS IS ALSO JUST A FEW DAYS

989

00:42:10,060 --> 00:42:13,130

AFTER CARL SAGAN AND I REALIZED

990

00:42:13,197 --> 00:42:15,432

HOW DEEPLY IN LOVE WE WERE, AND

991

00:42:15,499 --> 00:42:23,107

TOLD EACH OTHER ON JUNE 1, 1977,

992

00:42:23,173 --> 00:42:27,044

IN THE THROWS OF THE UNDERTAKING

993

00:42:27,111 --> 00:42:29,313

TO SPEAK FOR EARTH FOR BILLIONS

994

00:42:29,380 --> 00:42:29,813

OF YEARS.

995

00:42:29,880 --> 00:42:31,882

PART OF MY MEDITATION IS THE JOY

996

00:42:31,949 --> 00:42:34,418

OF A 27-YEAR-OLD WOMAN MADLY IN

997

00:42:34,485 --> 00:42:37,621

LOVE, TRULY IN LOVE AS EVERY

998

00:42:37,688 --> 00:42:39,356

SINGLE HEARTBEAT SINCE THAT

999

00:42:39,423 --> 00:42:42,426

MOMENT CAN AFFIRM.

1000

00:42:42,493 --> 00:42:47,998

SO THAT IS ON VOYAGER.

1001  
00:42:48,065 --> 00:42:49,700  
IF THAT EXAMINE BE INTERPRETED,

1002  
00:42:49,767 --> 00:42:53,270  
THEN IN SOME SENSE IT KEEPS US

1003  
00:42:53,337 --> 00:42:57,875  
AMEN ALIVE AND THE GREATEST

1004  
00:42:57,942 --> 00:42:58,776  
FEELEST AND DEEPEST JOYS WE'VE

1005  
00:42:58,842 --> 00:42:59,410  
EVER KNOWN.

1006  
00:42:59,476 --> 00:43:00,444  
>> ONE MORE QUESTION.

1007  
00:43:00,511 --> 00:43:04,548  
>> DO YOU THINK VOYAGER 2 WILL

1008  
00:43:04,615 --> 00:43:10,754  
REACH BEFORE IT'S BATTERIES

1009  
00:43:10,821 --> 00:43:11,689  
FARTHER--

1010  
00:43:11,755 --> 00:43:13,958  
>> WILL VOYAGER 2?

1011  
00:43:14,024 --> 00:43:16,427  
WE EXPECT SO.

1012  
00:43:16,493 --> 00:43:18,228  
IT HAS SEVERAL MORE YEARS.

1013  
00:43:18,295 --> 00:43:19,997

TO THAT ORDER, TEN MORE YEARS.

1014

00:43:20,064 --> 00:43:21,832

IF WE DON'T REACH IT IN TEN

1015

00:43:21,899 --> 00:43:24,234

YEARS, THAT WILL BE A VERY BIG

1016

00:43:24,301 --> 00:43:25,002

SURPRISE.

1017

00:43:25,069 --> 00:43:26,637

>> OKAY, WELL, WE HAVE A SECOND

1018

00:43:26,704 --> 00:43:30,541

PANEL THAT'S COMING UP WITH

1019

00:43:30,607 --> 00:43:32,142

YOUNGER SCIENTISTS WHOSE LIVES

1020

00:43:32,209 --> 00:43:33,344

AND CAREERS HAVE BEEN IMPACTED

1021

00:43:33,410 --> 00:43:34,678

BY VOYAGER.

1022

00:43:34,745 --> 00:43:36,513

BUT FIRST WE HAVE SOMETHING

1023

00:43:36,580 --> 00:43:38,015

YOU'RE GOING TO FIND VERY COOL.

1024

00:43:38,082 --> 00:43:40,117

WE'RE GOING TO THROW THINGS OVER

1025

00:43:40,184 --> 00:43:42,920

TO JPL TO MISSION CONTROL FOR

1026  
00:43:42,987 --> 00:43:44,188  
THE VOYAGER INTERSTELLAR

1027  
00:43:44,254 --> 00:43:47,291  
MISSION, AND THERE WE HAVE TRACY

1028  
00:43:47,358 --> 00:43:48,892  
TO EXPLAIN WHAT IS GOING TO

1029  
00:43:48,959 --> 00:43:52,062  
HAPPEN.

1030  
00:43:52,129 --> 00:43:57,401  
TRACY?

1031  
00:43:57,468 --> 00:43:59,470  
>> THANKS.

1032  
00:43:59,536 --> 00:44:03,540  
I'M TRACY HERE IN PASADENA,

1033  
00:44:03,607 --> 00:44:04,208  
CALIFORNIA.

1034  
00:44:04,274 --> 00:44:05,309  
THIS IS MISSION CONTROL FOR THE

1035  
00:44:05,376 --> 00:44:06,877  
DEEP SPACE NETWORK.

1036  
00:44:06,944 --> 00:44:08,479  
THIS IS WHERE SPACECRAFT FROM

1037  
00:44:08,545 --> 00:44:10,614  
ALL OVER THE SOLAR SYSTEM AND

1038  
00:44:10,681 --> 00:44:11,448

BEYOND COMMUNICATE WITH THE

1039

00:44:11,515 --> 00:44:13,484

EARTH THROUGH A SET OF LARGE

1040

00:44:13,550 --> 00:44:14,551

ANTENNA DISTRIBUTED AROUND THE

1041

00:44:14,618 --> 00:44:16,153

WORLD IN WHAT WE CALL THE DEEP

1042

00:44:16,220 --> 00:44:18,255

SPACE NETWORK.

1043

00:44:18,322 --> 00:44:20,057

THE VOYAGERS HAVE BEEN

1044

00:44:20,124 --> 00:44:21,425

COMMUNICATING WITH US THIS WAY

1045

00:44:21,492 --> 00:44:22,526

FOR FOUR DECADES.

1046

00:44:22,593 --> 00:44:24,762

WE'RE IN A COMMUNICATION PASS OF

1047

00:44:24,828 --> 00:44:25,729

VOYAGER ONE TODAY.

1048

00:44:25,796 --> 00:44:26,930

YOU CAN SEE ON THIS LIVE STREAM

1049

00:44:26,997 --> 00:44:28,565

BEHIND ME THAT WE'RE TALKING

1050

00:44:28,632 --> 00:44:30,667

WITH VOYAGER ONE WITH STATION

1051  
00:44:30,734 --> 00:44:31,235  
63.

1052  
00:44:31,301 --> 00:44:32,836  
IN CELEBRATION OF 40 YEARS OF

1053  
00:44:32,903 --> 00:44:35,406  
CONTINUING EXPLORATION WITH THE

1054  
00:44:35,472 --> 00:44:37,841  
VOYAGERS, WE LAUNCHED A CAMPAIGN

1055  
00:44:37,908 --> 00:44:40,377  
CALLED "MESSAGE TO VOYAGER,"

1056  
00:44:40,444 --> 00:44:44,081  
INSPIRED BY UPLIFTING MESSAGES

1057  
00:44:44,148 --> 00:44:46,183  
ON VOYAGERS GOLDEN RECORDS.

1058  
00:44:46,250 --> 00:44:50,020  
WE ASK YOU TO SUBMIT MESSAGES OF

1059  
00:44:50,087 --> 00:44:52,122  
GOOD WILL AND PUT OUT.

1060  
00:44:52,189 --> 00:44:54,124  
THESE HAD TO BE SHORT MESSAGES

1061  
00:44:54,191 --> 00:44:56,760  
NO MORE THAN 60 CHARACTERS.

1062  
00:44:56,827 --> 00:44:58,796  
SO WE'RE GOING TO REVEAL TODAY

1063  
00:44:58,862 --> 00:45:00,531

WHAT YOU CHOSE AS THE WINNING

1064

00:45:00,597 --> 00:45:01,999

MESSAGE AND SEND THAT ALL THE

1065

00:45:02,066 --> 00:45:05,202

WAY OUT TO VOYAGER 1 AND ENTER

1066

00:45:05,269 --> 00:45:10,774

STELLAR SPACE.

1067

00:45:10,841 --> 00:45:13,744

>> THIS IS JEFF.

1068

00:45:13,811 --> 00:45:16,914

>> HI TRACY, HOW ARE YOU DOING

1069

00:45:16,980 --> 00:45:17,748

TODAY?

1070

00:45:17,815 --> 00:45:20,017

>> I'M DOING GREAT.

1071

00:45:20,084 --> 00:45:23,020

WHAT IS THE MESSAGE TODAY.

1072

00:45:23,087 --> 00:45:26,056

>> WE PUT IT INTO A VOYAGER

1073

00:45:26,123 --> 00:45:27,658

COMMAND MESSAGE FORMAT, AND

1074

00:45:27,724 --> 00:45:31,028

SENDING IT UP TO VOYAGER RATE AT

1075

00:45:31,095 --> 00:45:32,129

16 BITS PER SECOND, WHICH MEANS

1076  
00:45:32,196 --> 00:45:34,031  
THAT IT WILL TAKE 28 SECONDS FOR

1077  
00:45:34,098 --> 00:45:36,967  
THE MESSAGE TO BE TOTALLY

1078  
00:45:37,034 --> 00:45:37,768  
TRANSMITTED.

1079  
00:45:37,835 --> 00:45:39,203  
ONCE IT'S TRANSMITTED IT WILL

1080  
00:45:39,269 --> 00:45:43,841  
TAKE A LITTLE OVER 19.25 HOURS

1081  
00:45:43,907 --> 00:45:47,044  
TO PASS BY VOYAGER ON ITS WAY TO

1082  
00:45:47,111 --> 00:45:51,715  
INTERSTELLAR SPACE.

1083  
00:45:51,782 --> 00:45:54,985  
>> HOW IS IT GOING TO BE SENT?

1084  
00:45:55,052 --> 00:45:55,986  
>> WE'RE TRANSMITTING OUTSIDE OF

1085  
00:45:56,053 --> 00:45:59,556  
THE MADRID, SPAIN, DEEP SPACE

1086  
00:45:59,623 --> 00:46:00,424  
STATION 63.

1087  
00:46:00,491 --> 00:46:01,825  
TO GIVE YOU AN IDEA OF HOW BIG

1088  
00:46:01,892 --> 00:46:04,495

THIS ANTENNA IS, 70 METERS IS

1089

00:46:04,561 --> 00:46:05,629

THREE-QUARTERS THE LENGTH OF A

1090

00:46:05,696 --> 00:46:06,497

FOOTBALL FIELD.

1091

00:46:06,563 --> 00:46:07,598

>> THAT'S PRETTY FANTASTIC.

1092

00:46:07,664 --> 00:46:08,265

THANK YOU, JEFF.

1093

00:46:08,332 --> 00:46:09,032

>> THANK YOU.

1094

00:46:09,099 --> 00:46:11,001

>> I WAS ONLY TWO YEARS OLD WHEN

1095

00:46:11,068 --> 00:46:12,636

THE VOYAGERS LAUNCHED, BUT BY

1096

00:46:12,703 --> 00:46:14,471

THE TIME I GOT TO ELEMENTARY

1097

00:46:14,538 --> 00:46:15,772

SCHOOL WE HAD ALREADY STARTED

1098

00:46:15,839 --> 00:46:19,209

GETTING BACK IMAGES OF JUPITER

1099

00:46:19,276 --> 00:46:20,878

AND SATURN THAT WERE REALLY

1100

00:46:20,944 --> 00:46:22,913

FANTASTIC AND HELPED INSPIRE ME

1101  
00:46:22,980 --> 00:46:24,281  
TO BE INTERESTED IN SPACE

1102  
00:46:24,348 --> 00:46:25,916  
EXPLORATION AND GROWING UP TO BE

1103  
00:46:25,983 --> 00:46:26,850  
AN ENGINEER.

1104  
00:46:26,917 --> 00:46:30,187  
MY MOM WAS ALSO VERY INTERESTED

1105  
00:46:30,254 --> 00:46:32,289  
IN SCIENCE FICTION, EMPHASIS

1106  
00:46:32,356 --> 00:46:33,056  
"STAR TREK."

1107  
00:46:33,123 --> 00:46:35,058  
I'VE BEEN A TREKKIE SINCE AS

1108  
00:46:35,125 --> 00:46:37,961  
LONG AS I CAN REMEMBER.

1109  
00:46:38,028 --> 00:46:45,769  
AND WHO BETTER TO SEND TODAY'S

1110  
00:46:45,836 --> 00:46:47,804  
MESSAGE TODAY THAN CAPTAIN KIRK.

1111  
00:46:47,871 --> 00:46:48,872  
THAT'S RIGHT.

1112  
00:46:48,939 --> 00:46:50,307  
WILLIAM SHATNER IS IN MISSION

1113  
00:46:50,374 --> 00:46:51,408

CONTROL TODAY.

1114

00:46:51,475 --> 00:46:52,109

>> WHAT AN HONOR.

1115

00:46:52,176 --> 00:46:53,577

I'M SO PLEASED TO BE HERE.

1116

00:46:53,644 --> 00:46:56,346

IT'S A MANAGEABLE PLACE, JPL,

1117

00:46:56,413 --> 00:46:58,982

AND THIS IS A MAGICAL MOMENT TO

1118

00:46:59,049 --> 00:47:01,818

SEND A MESSAGE TO VOYAGER, AND

1119

00:47:01,885 --> 00:47:03,987

ONCE IT REACHES VOYAGER IT KEEPS

1120

00:47:04,054 --> 00:47:04,688

GOING.

1121

00:47:04,755 --> 00:47:05,689

IT'S LIKE ADVANCE MAN.

1122

00:47:05,756 --> 00:47:07,858

VOYAGER COMING, VOYAGER COMING

1123

00:47:07,925 --> 00:47:09,426

TO ALL THE LITTLE GREEN PEOPLE

1124

00:47:09,493 --> 00:47:10,260

OUT THERE.

1125

00:47:10,327 --> 00:47:11,128

>> IT'S REALLY EXCITING.

1126

00:47:11,195 --> 00:47:14,731

WE CAN'T WAIT TO SEE OR HEAR IF

1127

00:47:14,798 --> 00:47:16,400

ANYBODY SAYS HELLO BACK TO US.

1128

00:47:16,466 --> 00:47:17,834

>> WOULDN'T THAT BE SOMETHING?

1129

00:47:17,901 --> 00:47:19,970

>> THAT WOULD BE AMAZING.

1130

00:47:20,037 --> 00:47:26,510

ALSO HERE ENGINEER ANNABELLE

1131

00:47:26,577 --> 00:47:26,843

KENNEDY.

1132

00:47:26,910 --> 00:47:29,780

SHE'S GETTING READY TO SEND THE

1133

00:47:29,846 --> 00:47:31,848

MESSAGE ON YOUR COMMAND.

1134

00:47:31,915 --> 00:47:33,217

>> SHE'S GOING TO PUSH THE

1135

00:47:33,283 --> 00:47:33,784

BUTTON.

1136

00:47:33,850 --> 00:47:34,718

>> THAT'S.

1137

00:47:34,785 --> 00:47:38,255

>> THIS MESSAGE WAS CHOSEN BY

1138

00:47:38,322 --> 00:47:41,992

COMMITTEE ONCE ALL THE ATTEMPTS

1139

00:47:42,059 --> 00:47:45,562

TO SHOW US DOCTOR TO GIVE US A

1140

00:47:45,629 --> 00:47:47,064

MESSAGE, THERE WAS 30,000 OR

1141

00:47:47,130 --> 00:47:47,998

SOMETHING LIKE THAT.

1142

00:47:48,065 --> 00:47:50,267

>> THAT'S RIGHT, 30,000 PEOPLE.

1143

00:47:50,334 --> 00:47:51,235

>> 30,000 PEOPLE COMMUNICATED,

1144

00:47:51,301 --> 00:47:56,473

AND THIS WAS WHITTLED DOWN TO

1145

00:47:56,540 --> 00:47:56,974

TEN.

1146

00:47:57,040 --> 00:47:58,475

NOW ONE OF THE TEN HAS BEEN

1147

00:47:58,542 --> 00:48:01,378

CHOSEN, AND YOU'RE GOING TO GIVE

1148

00:48:01,445 --> 00:48:03,614

ME THE ENVELOPE.

1149

00:48:03,680 --> 00:48:04,748

THE ENVELOPE PLEASE.

1150

00:48:04,815 --> 00:48:06,250

AND WE READ THE MESSAGE.

1151  
00:48:06,316 --> 00:48:08,385  
AND ANNABELLE WILL PRESS THE

1152  
00:48:08,452 --> 00:48:11,989  
BUTTON, AND THE MESSAGE WILL GO

1153  
00:48:12,055 --> 00:48:17,227  
OUT TO VOYAGER TO GET THERE 19

1154  
00:48:17,294 --> 00:48:18,061  
HOURS LATER.

1155  
00:48:18,128 --> 00:48:18,929  
>> A LONG WAY AWAY.

1156  
00:48:18,996 --> 00:48:20,130  
ARE WE READY?

1157  
00:48:20,197 --> 00:48:21,698  
>> I'M SO EXCITED.

1158  
00:48:21,765 --> 00:48:23,600  
I'M WONDERING WHAT THEY WANTED

1159  
00:48:23,667 --> 00:48:24,668  
US TO SAY.

1160  
00:48:24,735 --> 00:48:28,872  
>> I WONDER, TOO?

1161  
00:48:28,939 --> 00:48:32,743  
>> ONLY LESS THAN 60 CHARACTERS.

1162  
00:48:32,809 --> 00:48:33,944  
THAT'S HALF A TWEET.

1163  
00:48:34,011 --> 00:48:34,845

>> THAT'S RIGHT.

1164

00:48:34,911 --> 00:48:35,879

IT'S NOT A LOT OF SPACE IN ORDER

1165

00:48:35,946 --> 00:48:39,116

TO PUT IN AN UPLIFTING MESSAGE.

1166

00:48:39,182 --> 00:48:41,218

>> NOT A LOT OF SPACE FOR LARGE

1167

00:48:41,285 --> 00:48:41,885

SPACE.

1168

00:48:41,952 --> 00:48:42,452

>> THAT'S RIGHT.

1169

00:48:42,519 --> 00:48:45,389

>> CAN WE HAVE THE ENVELOPE,

1170

00:48:45,455 --> 00:48:46,056

PLEASE?

1171

00:48:46,123 --> 00:48:48,525

>> CAN WE HAVE THE ENVELOPE.

1172

00:48:48,592 --> 00:48:49,059

[ CHUCKLING ]

1173

00:48:49,126 --> 00:48:49,726

>> HERE WE GO.

1174

00:48:49,793 --> 00:48:53,764

>> NOW I'M GOING TO OPEN IT UP.

1175

00:48:53,830 --> 00:49:01,171

AND OLIVER JENKINS--OLIVER

1176  
00:49:01,238 --> 00:49:04,608  
JENKINS IS THE MESSAGE THAT HAS

1177  
00:49:04,675 --> 00:49:05,442  
BEEN SELECTED.

1178  
00:49:05,509 --> 00:49:06,910  
ANNABELLE, THIS IS THE MESSAGE.

1179  
00:49:06,977 --> 00:49:08,578  
AM I GOING TO READ IT OUT?

1180  
00:49:08,645 --> 00:49:11,248  
>> YES, LET'S HAVE YOU READ IT.

1181  
00:49:11,315 --> 00:49:12,449  
>> WE OFFER FRIENDSHIP ACROSS

1182  
00:49:12,516 --> 00:49:13,750  
THE STARS.

1183  
00:49:13,817 --> 00:49:17,521  
YOU ARE NOT ALONE.

1184  
00:49:17,587 --> 00:49:18,355  
>> FANTASTIC.

1185  
00:49:18,422 --> 00:49:20,257  
>> WHAT A GREAT MESSAGE.

1186  
00:49:20,324 --> 00:49:21,558  
BY OLIVER JENKINS.

1187  
00:49:21,625 --> 00:49:22,459  
>> I LOVE THAT.

1188  
00:49:22,526 --> 00:49:24,461

>> ARE YOU GOING TO SEND IT OUT

1189

00:49:24,528 --> 00:49:25,162  
NOW.

1190

00:49:25,228 --> 00:49:26,596  
>> I'M READY TO SEND IT.

1191

00:49:26,663 --> 00:49:29,166  
>> ON THE FREQUENCIES.

1192

00:49:29,232 --> 00:49:30,334  
>> THEY'RE READY.

1193

00:49:30,400 --> 00:49:31,935  
>> I THOUGHT I WOULD TOSS THAT

1194

00:49:32,002 --> 00:49:34,004  
IN FOR THE TREKKIES.

1195

00:49:34,071 --> 00:49:36,907  
COMMAND ENGINEER ANNABELLE

1196

00:49:36,973 --> 00:49:38,241  
KENNEDY SEND THE MESSAGE.

1197

00:49:38,308 --> 00:49:39,242  
>> ON YOUR COMMAND.

1198

00:49:39,309 --> 00:49:42,813  
AND WE'RE ACTIVE ON THREE, TWO,

1199

00:49:42,879 --> 00:49:44,114  
ONE.

1200

00:49:44,181 --> 00:49:44,681  
ACTIVE.

1201  
00:49:44,748 --> 00:49:47,718  
AND WE ARE RADIATING MESSAGE TO

1202  
00:49:47,784 --> 00:49:53,757  
VOYAGER AT 17:20.01.

1203  
00:49:53,824 --> 00:49:55,192  
>> THAT'S FANTASTIC.

1204  
00:49:55,258 --> 00:49:58,328  
>> I'M SO DELIGHTED.

1205  
00:49:58,395 --> 00:49:58,962  
[APPLAUSE]

1206  
00:49:59,029 --> 00:50:01,798  
WHEN YOU THINK OF THE MYSTERIOUS

1207  
00:50:01,865 --> 00:50:03,500  
VOID THAT IS OUT THERE, AND WHAT

1208  
00:50:03,567 --> 00:50:05,268  
LITTLE WE KNOW AND WE'RE SENDING

1209  
00:50:05,335 --> 00:50:07,270  
A MESSAGE OUT, AND IT GOES INTO

1210  
00:50:07,337 --> 00:50:08,238  
THE STARS.

1211  
00:50:08,305 --> 00:50:09,873  
IT GOES--WE DON'T KNOW HOW LONG

1212  
00:50:09,940 --> 00:50:10,707  
THAT WILL TAKE.

1213  
00:50:10,774 --> 00:50:13,076

HOW LONG WILL THAT TAKE?

1214

00:50:13,143 --> 00:50:17,547

I DON'T MEAN HOW LONG, THIS

1215

00:50:17,614 --> 00:50:18,482

ELECTRICAL IMPULSE.

1216

00:50:18,548 --> 00:50:19,816

>> TRAVELING THE SPEED OF LIGHT.

1217

00:50:19,883 --> 00:50:20,951

>> TRAVELING THE SPEED OF

1218

00:50:21,017 --> 00:50:22,786

LIGHT--DOES IT EVER DECAY?

1219

00:50:22,853 --> 00:50:25,722

>> IT CAN--IT WILL SPREAD OUT

1220

00:50:25,789 --> 00:50:27,891

EVENTUALLY OVER MANY, MANY, MANY

1221

00:50:27,958 --> 00:50:29,559

LIGHT YEARS.

1222

00:50:29,626 --> 00:50:30,227

>> YES.

1223

00:50:30,293 --> 00:50:31,762

>> BUT EVENTUALLY IF THERE IS

1224

00:50:31,828 --> 00:50:33,363

SOMETHING OUT THERE WITH A BIG

1225

00:50:33,430 --> 00:50:35,565

ENOUGH ANTENNA TO LISTEN, WHO

1226  
00:50:35,632 --> 00:50:36,900  
KNOWS.

1227  
00:50:36,967 --> 00:50:39,536  
>> I FIGURE THEY DON'T NEED BIG

1228  
00:50:39,603 --> 00:50:40,137  
ANTENNAS.

1229  
00:50:40,203 --> 00:50:42,272  
THEY HAVE LITTLE--SO IT SPREADS

1230  
00:50:42,339 --> 00:50:43,673  
OUT AND GOES FOREVER.

1231  
00:50:43,740 --> 00:50:44,708  
>> IT GOES FOREVER.

1232  
00:50:44,775 --> 00:50:48,178  
>> BECAUSE IT'S A LIGHT, IT'S A

1233  
00:50:48,245 --> 00:50:50,347  
PHOTON.

1234  
00:50:50,414 --> 00:50:55,952  
>> RADIO FREQUENCIES.

1235  
00:50:56,019 --> 00:50:57,554  
>> RIGHT, BUT IT'S NOT A PHOTON.

1236  
00:50:57,621 --> 00:50:59,256  
>> IT'S NOT A PHOTON.

1237  
00:50:59,322 --> 00:50:59,923  
>> OKAY.

1238  
00:50:59,990 --> 00:51:01,425

I'M SO HAPPY.

1239

00:51:01,491 --> 00:51:02,225

THANK YOU SO MUCH.

1240

00:51:02,292 --> 00:51:03,360

>> THANK YOU SO MUCH FOR BEING

1241

00:51:03,427 --> 00:51:03,927

WITH US.

1242

00:51:03,994 --> 00:51:05,896

AND WE'RE GOING TO PASS THIS OUT

1243

00:51:05,962 --> 00:51:08,999

TO MATTHEW IN WASHINGTON, D.C.

1244

00:51:09,065 --> 00:51:19,009

[APPLAUSE]

1245

00:51:19,075 --> 00:51:20,911

>> WE'RE BACK AT THE NATIONAL

1246

00:51:20,977 --> 00:51:24,548

AIR AND SPACE MUSEUM HERE ON THE

1247

00:51:24,614 --> 00:51:25,982

SMITHSONIAN GROUNDS OF THE

1248

00:51:26,049 --> 00:51:26,883

NATIONAL MALL, AND WE HAVE OUR

1249

00:51:26,950 --> 00:51:27,350

SECOND PANEL.

1250

00:51:27,417 --> 00:51:28,852

WE HAVE TWO NEW FOLKS JOINING

1251  
00:51:28,919 --> 00:51:29,820  
THE PANEL.

1252  
00:51:29,886 --> 00:51:33,957  
I WON'T REINTRODUCE THE FOLKS

1253  
00:51:34,024 --> 00:51:37,294  
YOU ALREADY KNOW, BUT WE HAVE

1254  
00:51:37,360 --> 00:51:43,533  
MORGAN CABLE, SCIENTIST IN

1255  
00:51:43,600 --> 00:51:44,401  
CALIFORNIA.

1256  
00:51:44,468 --> 00:51:47,537  
STUDYING LIFE AND EXTREME

1257  
00:51:47,604 --> 00:51:48,572  
ENVIRONMENTS.

1258  
00:51:48,638 --> 00:51:50,207  
CURRENTLY DR. CABLE IS A SYSTEMS

1259  
00:51:50,273 --> 00:51:52,876  
ENGINEER FOR THE CASSINI

1260  
00:51:52,943 --> 00:51:55,579  
MISSION, WHICH HAS BEEN

1261  
00:51:55,645 --> 00:51:57,848  
EXPLORING THE SATURN SYSTEM FOR

1262  
00:51:57,914 --> 00:51:59,216  
13 YEARS.

1263  
00:51:59,282 --> 00:52:05,155

SHE'S ALSO A COLLABORATOR FOR

1264

00:52:05,222 --> 00:52:09,292

EUROPA, THE NEXT MISSION TO

1265

00:52:09,359 --> 00:52:26,209

JUPITER'S ICY MOON.

1266

00:52:26,276 --> 00:52:32,182

OUR NEXT DOCTOR HAS PUBLISHED

1267

00:52:32,249 --> 00:52:38,388

ARTICLES, A COUPLE VERY

1268

00:52:38,455 --> 00:52:39,589

ACCOMPLISHED YOUNG SCIENTISTS.

1269

00:52:39,656 --> 00:52:42,025

SO LET ME START BY ASKING

1270

00:52:42,092 --> 00:52:44,427

DR. CABLE A FEW QUESTIONS.

1271

00:52:44,494 --> 00:52:45,996

HOW HAS VOYAGER INFLUENCED YOUR

1272

00:52:46,062 --> 00:52:48,365

CAREER AS A SCIENTIST?

1273

00:52:48,431 --> 00:52:50,767

>> WELL, VOYAGER HAS HAD IMMENSE

1274

00:52:50,834 --> 00:52:52,402

IMPACT ON ALL THE CAREERS

1275

00:52:52,469 --> 00:52:55,372

SCIENTISTS OF MY GENERATION.

1276  
00:52:55,438 --> 00:52:57,274  
FOR ME PERSONALLY IT'S BEEN MORE

1277  
00:52:57,340 --> 00:52:59,409  
OF AN IMPACT THAT PEOPLE HAVE

1278  
00:52:59,476 --> 00:53:00,076  
MADE.

1279  
00:53:00,143 --> 00:53:05,415  
BEING ABLE TO WORK ALONG SIDE

1280  
00:53:05,482 --> 00:53:18,261  
PEOPLE LIKE DR. ED STONE, AND

1281  
00:53:18,328 --> 00:53:20,030  
UNDER MENTORSHIP I'VE BEEN ABLE

1282  
00:53:20,096 --> 00:53:22,399  
TO EXCEL, AND IT'S BEEN AN

1283  
00:53:22,465 --> 00:53:24,134  
INCREDIBLE WAY TO START TO FIND

1284  
00:53:24,200 --> 00:53:28,238  
MY OWN PATH AS A SCIENTIST IN

1285  
00:53:28,305 --> 00:53:33,009  
PLAN TORE SCIENCE AND SPACE

1286  
00:53:33,076 --> 00:53:37,847  
EXPLORATION.

1287  
00:53:37,914 --> 00:53:40,050  
>> WHAT HAVE YOU BEEN STUDYING.

1288  
00:53:40,116 --> 00:54:03,406

>> MOONS ARE EXCITING TO ME.

1289

00:54:03,473 --> 00:54:05,141

ESPECIALLY THOSE WITH OCEANS.

1290

00:54:05,208 --> 00:54:07,410

HERE THIS IS AN IMAGE THAT

1291

00:54:07,477 --> 00:54:08,278

VOYAGER TOOK.

1292

00:54:08,345 --> 00:54:10,046

THIS IS ONE OF THOSE OCEAN

1293

00:54:10,113 --> 00:54:13,516

WORLDS IN ORBIT AROUND SATURN.

1294

00:54:13,583 --> 00:54:17,654

BACK WHEN VOYAGER WAS--VOYAGER

1295

00:54:17,721 --> 00:54:21,424

TWO WAS DOING THE FLY BY, WE

1296

00:54:21,491 --> 00:54:24,094

CAPTURED THE IMAGES AND THIS IS

1297

00:54:24,160 --> 00:54:27,330

THE WHITEST AND BRIGHTEST MOONS

1298

00:54:27,397 --> 00:54:29,332

IN THE SOLAR SYSTEM.

1299

00:54:29,399 --> 00:54:32,035

IT WAS NOT ABLE TO GET IMAGE AS

1300

00:54:32,102 --> 00:54:34,771

IT WAS LEAVING, SORT OF PASSING

1301  
00:54:34,838 --> 00:54:35,405  
BY SATURN.

1302  
00:54:35,472 --> 00:54:38,375  
IF IT HAD, IT MIGHT HAVE

1303  
00:54:38,441 --> 00:54:40,243  
CAPTURED AN IMAGE OF THE PLUMES

1304  
00:54:40,310 --> 00:54:42,278  
THAT WE KNOW EMANATE OUT OF ITS

1305  
00:54:42,345 --> 00:54:42,946  
SOUTH POLE.

1306  
00:54:43,013 --> 00:54:46,316  
THIS IS AN IMAGE CAPTURED BY

1307  
00:54:46,383 --> 00:54:47,884  
CASSINI, A FOLLOW-ON MISSION

1308  
00:54:47,951 --> 00:54:49,919  
THAT FOR THE NEXT TEN DAYS IN

1309  
00:54:49,986 --> 00:54:51,554  
THE SATURN SYSTEM.

1310  
00:54:51,621 --> 00:54:53,256  
AND SEPTEMBER 15TH EARLY IN THE

1311  
00:54:53,323 --> 00:54:55,258  
MORNING WATCH THE FINAL GRAND

1312  
00:54:55,325 --> 00:54:56,726  
FINALE OF THAT MISSION.

1313  
00:54:56,793 --> 00:54:58,828

AND CAPTURED THIS AMAZING

1314

00:54:58,895 --> 00:54:59,629

MISSION.

1315

00:54:59,696 --> 00:55:02,499

AND THE NEXT SLIDE IS WHAT

1316

00:55:02,565 --> 00:55:05,402

VOYAGER 2 WOULD HAVE SEEN HAD

1317

00:55:05,468 --> 00:55:09,072

THAT SCAN PLATFORM HAD BEEN

1318

00:55:09,139 --> 00:55:09,839

WORKING.

1319

00:55:09,906 --> 00:55:12,976

HAD IS IN THE SOUTH POLAR

1320

00:55:13,043 --> 00:55:15,645

TERRAIN, PREOCEAN WATERS

1321

00:55:15,712 --> 00:55:16,646

STREAMING INTO SPACE.

1322

00:55:16,713 --> 00:55:19,115

WE KNOW ABOUT THESE WHIRLEDS

1323

00:55:19,182 --> 00:55:22,052

FROM MISSIONS FROM CASSINI, AND

1324

00:55:22,118 --> 00:55:24,387

BUILDING ON THAT KNOWLEDGE, AND

1325

00:55:24,454 --> 00:55:25,588

IT'S A FUN TIME.

1326  
00:55:25,655 --> 00:55:26,790  
>> SO WE CAN BETTER UNDERSTAND

1327  
00:55:26,856 --> 00:55:29,159  
THIS, IS THERE ANYTHING ON EARTH

1328  
00:55:29,225 --> 00:55:30,560  
THAT YOU CAN COMPARE THESE TWO?

1329  
00:55:30,627 --> 00:55:31,494  
>> LET'S SEE, THE BEST

1330  
00:55:31,561 --> 00:55:34,297  
COMPARISON I THINK FOR THESE

1331  
00:55:34,364 --> 00:55:35,865  
TYPES OF PLUMES EMNATIONS WOULD

1332  
00:55:35,932 --> 00:55:38,034  
BE A GEYSER LIKE IN ICELAND OR

1333  
00:55:38,101 --> 00:55:39,302  
SOMETHING LIKE THAT.

1334  
00:55:39,369 --> 00:55:40,637  
BUT THIS SCALE IS VERY, VERY

1335  
00:55:40,704 --> 00:55:41,504  
DIFFERENT.

1336  
00:55:41,571 --> 00:55:46,609  
THOSE GEYSERS MAY BE SPRAY

1337  
00:55:46,676 --> 00:55:49,079  
10 METERS IN THE AIR?

1338  
00:55:49,145 --> 00:55:51,414

BUT THESE PLUMES EMANATING,

1339

00:55:51,481 --> 00:55:55,051

SINGLE PLUMES, MANY JETS FROM A

1340

00:55:55,118 --> 00:55:57,921

SINGLE PLUME FORM THAT E RING

1341

00:55:57,987 --> 00:56:00,156

THAT IS AROUND SATURN.

1342

00:56:00,223 --> 00:56:01,224

ONE OF THE RINGS IS FORMED

1343

00:56:01,291 --> 00:56:05,295

BECAUSE OF THIS MATERIAL COMING

1344

00:56:05,361 --> 00:56:05,862

OUT.

1345

00:56:05,929 --> 00:56:07,263

>> WHAT ARE YOUR PLANS FOR THE

1346

00:56:07,330 --> 00:56:07,731

FUTURE?

1347

00:56:07,797 --> 00:56:10,633

WHAT DO YOU WANT TO EXPLORE

1348

00:56:10,700 --> 00:56:12,736

NEXT?

1349

00:56:12,802 --> 00:56:14,704

>> EVERYTHING.

1350

00:56:14,771 --> 00:56:15,305

NASATV, COMEA

1351  
00:56:15,371 --> 00:56:15,839  
NDTAKEALOOKATTHATMOD

1352  
00:56:15,905 --> 00:56:18,875  
EL IS CURRENTLY WORKING ON A

1353  
00:56:18,942 --> 00:56:19,609  
MISSION.

1354  
00:56:19,676 --> 00:56:21,578  
I'M LUCKY TO BE A PART OF.

1355  
00:56:21,644 --> 00:56:28,852  
WE HAVE A LOOKING FURTHER OUT,

1356  
00:56:28,918 --> 00:56:33,590  
THESE FASCINATING PLACES LIKE

1357  
00:56:33,656 --> 00:56:36,826  
TRITON.

1358  
00:56:36,893 --> 00:56:40,096  
IT'S CREATING VOLCANOS INTO

1359  
00:56:40,163 --> 00:56:40,797  
SPACE.

1360  
00:56:40,864 --> 00:56:55,845  
THERE IS SO MUCH TO EXPLORE.

1361  
00:56:55,912 --> 00:56:57,747  
>> HOW DID YOU GET INVOLVED?

1362  
00:56:57,814 --> 00:56:58,948  
>> OUR PROFESSOR CAME IN AND

1363  
00:56:59,015 --> 00:57:00,483

SHOWED US THESE OBSERVATIONS

1364

00:57:00,550 --> 00:57:04,554

FROM THE EXPLORER THAT WAS JUST

1365

00:57:04,621 --> 00:57:17,367

TAKEN.

1366

00:57:17,433 --> 00:57:18,868

THEY TRAVEL THROUGH SPACE AND

1367

00:57:18,935 --> 00:57:22,005

CAN BE DETECTED ON EARTHS.

1368

00:57:22,071 --> 00:57:23,273

OUR PROFESSOR SHOWED US THESE

1369

00:57:23,339 --> 00:57:24,140

OBSERVATIONS.

1370

00:57:24,207 --> 00:57:25,842

THEY SAID THESE ARE EXCITING,

1371

00:57:25,909 --> 00:57:31,181

BUT TOTALLY UNEXPECTED.

1372

00:57:31,247 --> 00:57:35,318

WE HAVE A BRIEF ANIMATION WE CAN

1373

00:57:35,385 --> 00:57:35,985

SHOW.

1374

00:57:36,052 --> 00:57:38,288

THIS IS A SKY MAP THAT SHOWS THE

1375

00:57:38,354 --> 00:57:41,658

PICTURE OF THE SKY IN SIX

1376  
00:57:41,724 --> 00:57:46,095  
MONTHS.

1377  
00:57:46,162 --> 00:57:49,933  
YOU CAN SEE THIS IS VOYAGER 1

1378  
00:57:49,999 --> 00:57:51,134  
WHERE THEY'RE GOING AWAY FROM

1379  
00:57:51,201 --> 00:57:51,734  
THE EARTH.

1380  
00:57:51,801 --> 00:57:54,137  
AND IN THE BACKGROUND YOU SEE

1381  
00:57:54,204 --> 00:58:01,211  
ALL THESE NEUTRAL ITEMS FROM

1382  
00:58:01,277 --> 00:58:01,778  
SPACE.

1383  
00:58:01,845 --> 00:58:03,646  
WHAT WAS UNEXPECTED WAS THIS

1384  
00:58:03,713 --> 00:58:07,750  
BAND GOING ACROSS THE SKY.

1385  
00:58:07,817 --> 00:58:09,018  
ESSENTIALLY IT EXCITED EVERYONE

1386  
00:58:09,085 --> 00:58:10,520  
WHO WAS WORKING ON IT, AND I

1387  
00:58:10,587 --> 00:58:13,423  
DECIDED TO DO MY UNDERGRADUATE

1388  
00:58:13,489 --> 00:58:14,958

PROJECT ON IT, AND IT'S BEEN

1389

00:58:15,024 --> 00:58:16,860

LIKE THAT EVER SINCE.

1390

00:58:16,926 --> 00:58:17,427

>> WOW.

1391

00:58:17,493 --> 00:58:20,363

WE HAVE SEEN VOYAGER 1 AND

1392

00:58:20,430 --> 00:58:22,599

VOYAGER 2 IN YOUR GRAPHERRICS.

1393

00:58:22,665 --> 00:58:25,134

HAS YOUR WORK INTERSECTED WITH

1394

00:58:25,201 --> 00:58:27,637

THE VOYAGER EXPLORATION?

1395

00:58:27,704 --> 00:58:30,673

>> VOYAGER GIVES THE GROUND

1396

00:58:30,740 --> 00:58:36,579

TRUTH, AND IT ACTUALLY TELLS US

1397

00:58:36,646 --> 00:58:39,148

WHAT IS ACTUALLY HAPPENING IN

1398

00:58:39,215 --> 00:58:40,250

LOCATION IN SPACE.

1399

00:58:40,316 --> 00:58:42,719

SO USING THEM SIMULTANEOUSLY IS

1400

00:58:42,785 --> 00:58:44,254

REALLY IMPORTANT FOR OUR

1401  
00:58:44,320 --> 00:58:45,088  
RESEARCH.

1402  
00:58:45,154 --> 00:58:48,057  
SO EVER SINCE IT WAS OFFICIALLY

1403  
00:58:48,124 --> 00:58:51,628  
CONFIRMED THAT VOYAGER ONE HAD

1404  
00:58:51,694 --> 00:58:55,732  
CROSSED THE HELIO POD, THOSE

1405  
00:58:55,798 --> 00:58:57,333  
STRANGE MAGNETIC FIELD

1406  
00:58:57,400 --> 00:58:58,735  
OBSERVATIONS WERE MAYBE NOT THAT

1407  
00:58:58,801 --> 00:59:01,437  
STRANGE AFTER ALL.

1408  
00:59:01,504 --> 00:59:03,273  
SO THE GRAPHIC THAT WE'RE

1409  
00:59:03,339 --> 00:59:10,980  
SHOWING, IF YOU FIRST IMAGINE IT

1410  
00:59:11,047 --> 00:59:13,449  
COMING UP FROM THE SUN, IT'S

1411  
00:59:13,516 --> 00:59:17,720  
CALLED HELIOPODS, IT'S

1412  
00:59:17,787 --> 00:59:18,488  
COMET-SHAPED.

1413  
00:59:18,554 --> 00:59:21,257

THIS SURFACE IS THE SURFACE OF

1414

00:59:21,324 --> 00:59:21,691

THAT BUBBLE.

1415

00:59:21,758 --> 00:59:25,395

AND THEN ON THE OUTSIDE OF IT IS

1416

00:59:25,461 --> 00:59:26,963

INTERSTELLAR SPACE.

1417

00:59:27,030 --> 00:59:28,898

YOU SEE VOYAGER 1 IS OUTSIDE OF

1418

00:59:28,965 --> 00:59:31,334

THE PODS, AND IT'S STILL CLOSE

1419

00:59:31,401 --> 00:59:32,168

ON THE SCALES.

1420

00:59:32,235 --> 00:59:33,736

AND THEN THIS IS VOYAGER 2 STILL

1421

00:59:33,803 --> 00:59:37,573

INSIDE, SO THERE IS NO PICTURE.

1422

00:59:37,640 --> 00:59:39,075

WHAT WE CAN SEE IN THE

1423

00:59:39,142 --> 00:59:41,678

STIMULATION IS THAT THE MAGNETIC

1424

00:59:41,744 --> 00:59:43,046

FIELD, THOSE BLACK CURVES TAKEN

1425

00:59:43,112 --> 00:59:44,314

FROM IT'S STOP LEFT TO THE

1426  
00:59:44,380 --> 00:59:46,683  
BOTTOM RIGHT, IS SHOWING US HOW

1427  
00:59:46,749 --> 00:59:49,619  
THE MAGNETIC FIELD IS WRAPPING

1428  
00:59:49,686 --> 00:59:52,588  
AROUND THE POD SURFACE, AND WE

1429  
00:59:52,655 --> 00:59:54,190  
BELIEVE WHAT VOYAGER IS TELLING

1430  
00:59:54,257 --> 00:59:56,459  
US IS HOW THESE LINES ARE

1431  
00:59:56,526 --> 00:59:57,961  
DRAPING AROUND THE SPHERE.

1432  
00:59:58,027 --> 01:00:00,430  
AND AS IT PROPAGATES FURTHER

1433  
01:00:00,496 --> 01:00:03,766  
FROM THE SUN, THIS SHOWS HOW

1434  
01:00:03,833 --> 01:00:05,935  
THIS FARTHEST INTERACTION GOES.

1435  
01:00:06,002 --> 01:00:07,370  
>> WHAT ARE YOUR PLANS IN THE

1436  
01:00:07,437 --> 01:00:08,004  
FUTURE?

1437  
01:00:08,071 --> 01:00:09,405  
WHAT DO YOU HOPE TO SEE?

1438  
01:00:09,472 --> 01:00:13,009

>> WELL, WE CAN CONTINUE TO SEE

1439

01:00:13,076 --> 01:00:16,579

MOTHER OBSERVATIONS AS IT GOES

1440

01:00:16,646 --> 01:00:17,180

38 MPH.

1441

01:00:17,246 --> 01:00:18,014

AND IT'S GOING TO PROVIDE US

1442

01:00:18,081 --> 01:00:22,185

WITH MORE AND MORE IMPORTANT

1443

01:00:22,251 --> 01:00:24,220

OBSERVATIONS FOR THE NEXT TEN

1444

01:00:24,287 --> 01:00:24,954

YEARS.

1445

01:00:25,021 --> 01:00:26,622

OUR COMMUNITY, WE'RE DEFINITELY

1446

01:00:26,689 --> 01:00:30,193

EXPECTING VOYAGER TWO TO CROSS

1447

01:00:30,259 --> 01:00:34,897

THE HEL IPOD DOWN AT THE

1448

01:00:34,964 --> 01:00:35,798

BOTTOM IS THERE.

1449

01:00:35,865 --> 01:00:37,066

WE BELIEVE IT WILL BE IN THE

1450

01:00:37,133 --> 01:00:38,701

NEXT FEW YEARS, BUT WE HAVE TO

1451

01:00:38,768 --> 01:00:40,370

WAIT AND SEE.

1452

01:00:40,436 --> 01:00:43,072

BUT WHAT VOYAGER HAS SHOWN US IS

1453

01:00:43,139 --> 01:00:46,109

NOT ONLY ARE THESE EXCITING

1454

01:00:46,175 --> 01:00:47,243

OBSERVATIONS, BUT IT'S

1455

01:00:47,310 --> 01:00:48,644

DEFINITELY CAPABLE, WE'RE

1456

01:00:48,711 --> 01:00:49,946

DEFINITELY CAPABLE OF DOING

1457

01:00:50,013 --> 01:00:50,380

THIS.

1458

01:00:50,446 --> 01:00:52,081

AND HOPEFULLY IT WILL BE ONE OF

1459

01:00:52,148 --> 01:00:53,383

MANY IN THE FUTURE.

1460

01:00:53,449 --> 01:00:53,950

>> FANTASTIC.

1461

01:00:54,017 --> 01:00:56,085

SO NOW I THINK WE HAVE SOME TIME

1462

01:00:56,152 --> 01:00:57,253

FOR SOME AUDIENCE QUESTIONS.

1463

01:00:57,320 --> 01:00:58,755

AND I THINK WE HAVE A SOCIAL

1464

01:00:58,821 --> 01:00:59,822

MEDIA QUESTION.

1465

01:00:59,889 --> 01:01:01,057

IF ANYONE FROM THE AUDIENCE HAS

1466

01:01:01,124 --> 01:01:02,191

A QUESTION, YOU CAN MAKE YOUR

1467

01:01:02,258 --> 01:01:04,360

WAY OVER TO THE MICROPHONE IN

1468

01:01:04,427 --> 01:01:07,330

THIS AISLE OVER HERE.

1469

01:01:07,397 --> 01:01:09,599

>> THE HELLO, THIS IS REALLY AN

1470

01:01:09,665 --> 01:01:10,933

INSPIRING DAY.

1471

01:01:11,000 --> 01:01:12,468

THANK YOU FOR THIS.

1472

01:01:12,535 --> 01:01:14,537

THANK YOU FOR ALL YOU'VE DONE.

1473

01:01:14,604 --> 01:01:19,675

I'VE ALWAYS BEEN CURIOUS AS IN

1474

01:01:19,742 --> 01:01:21,844

SPACE SINCE I WAS A CHILD WHEN

1475

01:01:21,911 --> 01:01:25,014

MY DAD TOOK ME TO SEE SATURN.

1476

01:01:25,081 --> 01:01:27,617

WHEN WE SEND OUT THESE

1477

01:01:27,683 --> 01:01:29,685

INSPIRATIONAL MESSAGES AND SO

1478

01:01:29,752 --> 01:01:31,421

ON, AS SLIM AS THE CHANCE IS

1479

01:01:31,487 --> 01:01:33,356

THAT THEY'LL BE FOUND, WAS THERE

1480

01:01:33,423 --> 01:01:37,093

EVER ANY CONCERN THAT THEY MIGHT

1481

01:01:37,160 --> 01:01:38,661

NOT BE NICE GREEN PEOPLE WHO

1482

01:01:38,728 --> 01:01:41,831

FIND IT?

1483

01:01:41,898 --> 01:01:50,273

[ CHUCKLING ]

1484

01:01:50,339 --> 01:01:54,410

>> THE NATURE OF EXTRA

1485

01:01:54,477 --> 01:01:55,078

TERRESTRIALS.

1486

01:01:55,144 --> 01:01:59,715

SOMEONE AS ILLUSTRIOUS AS

1487

01:01:59,782 --> 01:02:03,052

STEPHEN HAWKINGS, MAY SAY DON'T

1488

01:02:03,119 --> 01:02:05,321

LET THEM KNOW THAT WE'RE HERE.

1489

01:02:05,388 --> 01:02:07,723

BUT IT'S BEEN TOO LATE FOR THAT.

1490

01:02:07,790 --> 01:02:09,625

WE'VE BEEN BROADCASTING

1491

01:02:09,692 --> 01:02:10,960

SOMETHING ON THE ORDER OF A

1492

01:02:11,027 --> 01:02:12,195

CENTURY, AND THE WORD IS OUT

1493

01:02:12,261 --> 01:02:13,096

THAT WE'RE HERE.

1494

01:02:13,162 --> 01:02:15,298

WHAT I FIND SO PUZZLING, AND

1495

01:02:15,364 --> 01:02:17,333

MAYBE BECAUSE I'VE BEEN SO LUCKY

1496

01:02:17,400 --> 01:02:21,537

TO HAVE A REALLY WONDERFUL LIFE,

1497

01:02:21,604 --> 01:02:24,140

IS THAT WE ALWAYS ASSUME THAT

1498

01:02:24,207 --> 01:02:26,075

THE EXTRA TERRESTRIALS WILL HAVE

1499

01:02:26,142 --> 01:02:28,678

TO BE TECHNOLOGICALLY MUCH MORE

1500

01:02:28,744 --> 01:02:29,946

ADVANCED THAN WE ARE.

1501

01:02:30,012 --> 01:02:33,516

AFTER ALL, THEY'RE SPACE FARING,

1502

01:02:33,583 --> 01:02:35,418

AND SUFFICIENTLY GOOD AT IT THAT

1503

01:02:35,485 --> 01:02:38,454

THEY CAN FLAG DOWN A DERELICT

1504

01:02:38,521 --> 01:02:41,157

SPACECRAFT IN THE MIDDLE OF

1505

01:02:41,224 --> 01:02:41,991

NOWHERE.

1506

01:02:42,058 --> 01:02:44,460

SO THEY'RE TECHNOLOGICALLY

1507

01:02:44,527 --> 01:02:45,228

ADVANCED.

1508

01:02:45,294 --> 01:02:47,096

BUT WE ALWAYS ASSUME THAT

1509

01:02:47,163 --> 01:02:51,534

THEY'LL BE EMOTIONALLY AND

1510

01:02:51,601 --> 01:02:55,004

SPIRITUALLY STUDENTED AS WE ARE,

1511

01:02:55,071 --> 01:02:56,339

THAT THEY WOULD TREAT US THE WAY

1512

01:02:56,405 --> 01:02:58,574

WE TREAT THE REST OF LIFE ON

1513

01:02:58,641 --> 01:02:59,942

## THIS PLANET AND THE WAY WE TREAT

1514

01:03:00,009 --> 01:03:00,977

EACH OTHER.

1515

01:03:01,043 --> 01:03:05,014

I SAY BEAUTIFUL UNTIL PROVEN

1516

01:03:05,081 --> 01:03:05,515

UGLY.

1517

01:03:05,581 --> 01:03:06,983

IT REALLY MAKES NO SENSE TO ME

1518

01:03:07,049 --> 01:03:09,418

THAT YOU COULD BE THAT GOOD AT

1519

01:03:09,485 --> 01:03:13,489

TRAVELING AT SPACE, MASTERING

1520

01:03:13,556 --> 01:03:15,858

THE PLANETARY QUARANTINE THAT

1521

01:03:15,925 --> 01:03:17,460

WE'RE BORN INTO, AND FIGURING

1522

01:03:17,527 --> 01:03:19,762

OUT ALL THE DIFFICULTIES AND

1523

01:03:19,829 --> 01:03:22,932

CHALLENGES OF BEING A SPACE

1524

01:03:22,999 --> 01:03:24,033

FARING CIVILIZATION, AND STILL

1525

01:03:24,100 --> 01:03:26,068

BEING OUT THERE HUNTING FOR

1526  
01:03:26,135 --> 01:03:27,403  
LUNCH OR SOMETHING TO WEAR.

1527  
01:03:27,470 --> 01:03:30,072  
IT JUST DOESN'T STRIKE ME AS

1528  
01:03:30,139 --> 01:03:30,673  
PRACTICAL.

1529  
01:03:30,740 --> 01:03:42,818  
AND SO I SAY THE VOYAGES ARE A

1530  
01:03:42,885 --> 01:03:44,320  
MESSAGE IN A BOTTLE IN SPACE.

1531  
01:03:44,387 --> 01:03:46,622  
THEY MOVE SO SLOWLY THAT, YOU

1532  
01:03:46,689 --> 01:03:49,458  
KNOW, OUR RADIO SIGNALS OUT RUN

1533  
01:03:49,525 --> 01:03:52,361  
THEM AT THE SPEED OF LIGHT.

1534  
01:03:52,428 --> 01:03:56,032  
WHILE THEY PROD ALONG AT MAXIMUM

1535  
01:03:56,098 --> 01:03:56,799  
45,000 MPH.

1536  
01:03:56,866 --> 01:04:02,104  
SO NOT TO WORRY.

1537  
01:04:02,171 --> 01:04:03,105  
>> DR. STONE, I WAS INVOLVED

1538  
01:04:03,172 --> 01:04:05,308

WITH THE FLY BY NEPTUNE.

1539

01:04:05,374 --> 01:04:17,320

YOU COULD SEE THOSE DARK CLOUDS

1540

01:04:17,386 --> 01:04:19,622

THERE WAS SPECULATION THAT

1541

01:04:19,689 --> 01:04:20,856

THEY'RE HYDROCARBONS.

1542

01:04:20,923 --> 01:04:23,159

>> I KNOW A LITTLE BIT ABOUT

1543

01:04:23,226 --> 01:04:23,693

THAT.

1544

01:04:23,759 --> 01:04:28,097

TRITON'S SURFACE IS MOSTLY

1545

01:04:28,164 --> 01:04:29,665

METHANE AND THIGHIO JEN.

1546

01:04:29,732 --> 01:04:33,436

AS IT MOVES THROUGH THE SEASON,

1547

01:04:33,502 --> 01:04:34,503

IT'S METHANE SNOW THAT MOVES AND

1548

01:04:34,570 --> 01:04:36,439

CONDENSES, SO IT MOVES FROM POLE

1549

01:04:36,505 --> 01:04:37,373

TO POLE.

1550

01:04:37,440 --> 01:04:40,243

SO WHEN HYDROCARBONS LIKE

1551  
01:04:40,309 --> 01:04:42,812  
METHANE OR NITROGEN GETS TRAPPED

1552  
01:04:42,878 --> 01:04:45,081  
UNDER THE SNOW AND WARMS UP, IT

1553  
01:04:45,147 --> 01:04:46,949  
TURNS TO A GAS THAT VENTS OUT.

1554  
01:04:47,016 --> 01:04:48,317  
THAT'S WHAT YOU'RE SEEING.

1555  
01:04:48,384 --> 01:04:50,620  
I BELIEVE THE DARK MARKS ARE

1556  
01:04:50,686 --> 01:04:51,988  
VERY SIMILAR TO MATERIAL THAT WE

1557  
01:04:52,054 --> 01:04:54,924  
SEE ON TITAN, WHICH IS WHEN

1558  
01:04:54,991 --> 01:04:57,226  
METHANE AND SOME OTHER SMALL

1559  
01:04:57,293 --> 01:05:00,263  
MOLECULES INTERACT WITH UV

1560  
01:05:00,329 --> 01:05:01,530  
RADIATION AND OTHER SOURCES IN

1561  
01:05:01,597 --> 01:05:04,734  
OUR SOLAR SYSTEM, IT FORMS OTHER

1562  
01:05:04,800 --> 01:05:13,876  
MOLECULES DARKER IN COLOR.

1563  
01:05:13,943 --> 01:05:17,813

IT WAS A TERM NAMED BY CARL

1564

01:05:17,880 --> 01:05:23,452

SAGAN BECAUSE OF MUDDY COLORS.

1565

01:05:23,519 --> 01:05:24,754

>> THIS QUESTION COMES FROM

1566

01:05:24,820 --> 01:05:25,454

TWITTER.

1567

01:05:25,521 --> 01:05:27,123

WHEN IS THE NEXT OPPORTUNITY FOR

1568

01:05:27,189 --> 01:05:34,163

A MISSION THAT FLY BY NEPTUNE.

1569

01:05:34,230 --> 01:05:36,599

>> SINCE IT TAKES A LONG TIME

1570

01:05:36,666 --> 01:05:39,335

WITH CHEMICAL PROPULSION, WE'LL

1571

01:05:39,402 --> 01:05:41,003

HAVE TO USE GRAVITY ASSIST.

1572

01:05:41,070 --> 01:05:42,471

I THINK THERE ARE HUNDREDS OF

1573

01:05:42,538 --> 01:05:43,773

POSSIBILITIES WITHIN THE NEXT

1574

01:05:43,839 --> 01:05:45,107

TEN YEARS OR SO TO DO THAT.

1575

01:05:45,174 --> 01:05:47,510

IT CAN BE DONE.

1576  
01:05:47,576 --> 01:05:51,213  
>> YES, AT LEAST AN URANIS ORBIT

1577  
01:05:51,280 --> 01:05:54,417  
INCLUDED IN THE RECENT SURVEY.

1578  
01:05:54,483 --> 01:05:58,354  
THERE ARE ICE SCIENTIST WHO IS

1579  
01:05:58,421 --> 01:06:00,690  
ARE INTERESTED IN EXPLORING

1580  
01:06:00,756 --> 01:06:02,258  
THESE FANTASTIC SYSTEMS.

1581  
01:06:02,325 --> 01:06:05,861  
>> ANOTHER AUDIENCE QUESTION.

1582  
01:06:05,928 --> 01:06:08,397  
>> I GOT A QUESTION ABOUT THE

1583  
01:06:08,464 --> 01:06:10,399  
SPACECRAFT ITSELF AND DEBRIS.

1584  
01:06:10,466 --> 01:06:13,536  
I KNOW YOU'RE MEASURING PLASMA,

1585  
01:06:13,602 --> 01:06:15,104  
BUT WHAT ABOUT DUST, AND DO YOU

1586  
01:06:15,171 --> 01:06:17,506  
EXPECT TO SEE SWISS CHEESE AT

1587  
01:06:17,573 --> 01:06:20,242  
THIS TIME STRUCTURALLY?

1588  
01:06:20,309 --> 01:06:21,711

>> IT TURNS OUT THAT SPACE IS

1589

01:06:21,777 --> 01:06:25,915

REALLY EMPTY, AND THE GOLD COVER

1590

01:06:25,981 --> 01:06:28,918

YOU SEE THERE IN THE IMAGE IS,

1591

01:06:28,984 --> 01:06:30,753

IN FACT, A DUST COVER.

1592

01:06:30,820 --> 01:06:32,254

THE RECORD IS BEHIND IT.

1593

01:06:32,321 --> 01:06:35,257

THAT COVER IS THICK ENOUGH--IT'S

1594

01:06:35,324 --> 01:06:38,260

THERE BECAUSE MICRO METEORITES

1595

01:06:38,327 --> 01:06:40,429

IN SPACE WOULD DISRUPT AND PIT

1596

01:06:40,496 --> 01:06:41,597

THE GLOVES IN THE RECORD.

1597

01:06:41,664 --> 01:06:43,232

BUT THEY BELIEVE THAT PLATE IS

1598

01:06:43,299 --> 01:06:46,535

MORE THAN ENOUGH TO GIVE A

1599

01:06:46,602 --> 01:06:47,536

BILLION-YEAR LIFETIME AGAINST

1600

01:06:47,603 --> 01:06:49,171

THIS TYPE OF DUST DAMAGE.

1601

01:06:49,238 --> 01:06:50,573

IT'S VERY UNLIKELY.

1602

01:06:50,639 --> 01:06:54,410

THESE ARE TINY METEORITES.

1603

01:06:54,477 --> 01:06:56,345

>> THIS WHOLE THING WHEN WE WERE

1604

01:06:56,412 --> 01:06:57,847

FIRST PROPOSING THIS, EVERYBODY

1605

01:06:57,913 --> 01:06:59,548

TOLD ME THAT YOU'RE WASTING YOUR

1606

01:06:59,615 --> 01:07:00,082

TIME.

1607

01:07:00,149 --> 01:07:02,017

YOU CANNOT GET THROUGH THE

1608

01:07:02,084 --> 01:07:03,185

ASTROID BELT WITH THAT

1609

01:07:03,252 --> 01:07:03,986

SPACECRAFT.

1610

01:07:04,053 --> 01:07:05,354

FORGET IT, YOU'RE NOT GOING TO

1611

01:07:05,421 --> 01:07:06,088

MAKE IT THROUGH.

1612

01:07:06,155 --> 01:07:07,223

I DON'T THINK THERE WAS ANY SIGN

1613

01:07:07,289 --> 01:07:13,796

OF ANY PROBLEM GOING THROUGH.

1614

01:07:13,863 --> 01:07:21,470

>> WITH ADVANCES IN AND THE

1615

01:07:21,537 --> 01:07:22,505

ABILITY TO CROWD SOURCE, HOW DO

1616

01:07:22,571 --> 01:07:24,607

YOU THINK THE PROCESS OF MAKING

1617

01:07:24,673 --> 01:07:26,675

ANOTHER PROJECT LIKE THE GOLDEN

1618

01:07:26,742 --> 01:07:28,611

RECORD WOULD BE, AND HOW

1619

01:07:28,677 --> 01:07:30,012

DIFFERENT DO YOU THINK THE END

1620

01:07:30,079 --> 01:07:33,582

RESULTS WOULD BE?

1621

01:07:33,649 --> 01:07:36,452

>> FIRST OF ALL, THE OPPORTUNITY

1622

01:07:36,519 --> 01:07:37,219

TO COMPRESS SO MUCH.

1623

01:07:37,286 --> 01:07:42,124

I MEAN, REALLY WITH OUR NANO

1624

01:07:42,191 --> 01:07:44,193

TECHNOLOGIES, AND OUR ABILITY TO

1625

01:07:44,260 --> 01:07:45,828

COMPRESS, WE COULD SEND THE

1626  
01:07:45,895 --> 01:07:47,430  
ENTIRE INTERNET ON THE NEXT

1627  
01:07:47,496 --> 01:07:48,597  
REALLY EPIC MISSION.

1628  
01:07:48,664 --> 01:07:54,437  
WE COULD SEND THE WHOLE

1629  
01:07:54,503 --> 01:07:55,938  
EVERYTHING WE ARE WITHOUT ANY

1630  
01:07:56,005 --> 01:07:56,572  
DIFFICULTY.

1631  
01:07:56,639 --> 01:08:00,409  
IT WAS A CHALLENGE IN 1977 TO

1632  
01:08:00,476 --> 01:08:07,550  
SELECT THE PIECES OF MUSIC, THE

1633  
01:08:07,616 --> 01:08:09,118  
WHITTLING PROCESS WAS

1634  
01:08:09,185 --> 01:08:11,020  
HEARTBREAKING AT TIMES FOR THE

1635  
01:08:11,086 --> 01:08:14,356  
SOUNDS AND GLEANINGS PRECISELY

1636  
01:08:14,423 --> 01:08:15,291  
BECAUSE OF THE FINITE SPACE

1637  
01:08:15,357 --> 01:08:26,202  
AVAILABLE ON A PHONOGRAPH

1638  
01:08:26,268 --> 01:08:26,902

RECORD.

1639

01:08:26,969 --> 01:08:28,337

IF WE WERE GOING TO SEND IT NOW,

1640

01:08:28,404 --> 01:08:31,574

YOU KNOW, IT'S A PROJECT THAT I

1641

01:08:31,640 --> 01:08:34,043

HAVE PERIPHERAL ASSOCIATION

1642

01:08:34,109 --> 01:08:37,246

BREAK THROUGH

1643

01:08:37,313 --> 01:08:42,985

CONTEMPLATING--IT'S CALLED BREAK

1644

01:08:43,052 --> 01:08:52,761

THROUGH STAR SHOT WITH GREATER

1645

01:08:52,828 --> 01:08:54,964

CAPABILITIES THAN EACH OF THE

1646

01:08:55,030 --> 01:08:57,600

VOYAGERS AND MOVING NOT AT

1647

01:08:57,666 --> 01:09:01,370

40,000 MPH, BUT ULTIMATELY IF

1648

01:09:01,437 --> 01:09:03,172

SUCCESSFUL, A SIGNIFICANT

1649

01:09:03,239 --> 01:09:07,610

FRACTION OF THE SPEED OF LIGHT.

1650

01:09:07,676 --> 01:09:09,678

THE POSSIBILITIES ARE INFINITELY NAT

1651  
01:09:09,745 --> 01:09:11,380  
IF WE GET OUR ACT TOGETHER HERE

1652  
01:09:11,447 --> 01:09:13,749  
ON EARTH.

1653  
01:09:13,816 --> 01:09:15,551  
>> I THINK WE HAVE TIME FOR TWO

1654  
01:09:15,618 --> 01:09:17,620  
MORE QUESTIONS.

1655  
01:09:17,686 --> 01:09:20,122  
>> I CERTAINLY HAVE ENJOYED

1656  
01:09:20,189 --> 01:09:21,790  
LISTENING TO ALL OF YOU, YOUNG

1657  
01:09:21,857 --> 01:09:24,560  
AND OLD, AND TO SEE THE VOYAGER

1658  
01:09:24,627 --> 01:09:25,461  
HAS A FUTURE.

1659  
01:09:25,528 --> 01:09:26,662  
BUT THERE IS SOMETHING GOING

1660  
01:09:26,729 --> 01:09:28,397  
AROUND ON THE INTERNET THAT I

1661  
01:09:28,464 --> 01:09:31,567  
HOPE SOMEBODY CAN DESCRIBE.

1662  
01:09:31,634 --> 01:09:34,370  
THAT IS THE EFFECTS THAT

1663  
01:09:34,436 --> 01:09:36,038

## PIONEERING VOYAGER HAD ON

1664

01:09:36,105 --> 01:09:43,846

GETTING RID OF PLANET X.

1665

01:09:43,913 --> 01:09:45,981

>> WELL, I THINK PIONEER TEN,

1666

01:09:46,048 --> 01:09:50,419

THEY TRACKED THE SPACECRAFT VERY

1667

01:09:50,486 --> 01:09:52,321

ACCURATELY THEY THOUGHT THERE

1668

01:09:52,388 --> 01:09:57,159

THEY HAD FOUND A SMALL RESIDUAL

1669

01:09:57,226 --> 01:09:59,094

ACCELERATION THAT WAS NOT

1670

01:09:59,161 --> 01:10:02,865

ACCOUNTED FOR BY KNOWN FISTICS.

1671

01:10:02,932 --> 01:10:06,168

THAT WOULD BE EXCITING IF THERE

1672

01:10:06,235 --> 01:10:11,974

WAS NEW PHYSICS AFFECTING THE

1673

01:10:12,041 --> 01:10:13,742

SCALE.

1674

01:10:13,809 --> 01:10:15,110

THEY HAVE CONCLUDED

1675

01:10:15,177 --> 01:10:17,713

UNFORTUNATELY THAT IT WAS REALLY

1676  
01:10:17,780 --> 01:10:20,149  
MATERIAL PROPERTIES HAVING TO DO

1677  
01:10:20,215 --> 01:10:21,517  
WITH THE SPACECRAFT RADIATING

1678  
01:10:21,584 --> 01:10:26,455  
THE HEAT OF WAVES FROM THE SUN.

1679  
01:10:26,522 --> 01:10:31,226  
THERE IS NO NEW PHYSICS

1680  
01:10:31,293 --> 01:10:32,094  
INVOLVED.

1681  
01:10:32,161 --> 01:10:40,603  
>> FIRST I WOULD LIKE TO THANK

1682  
01:10:40,669 --> 01:10:43,339  
NASA FOR RUINING MY BIRTHDAY

1683  
01:10:43,405 --> 01:10:48,277  
BECAUSE IT WENT UP FIVE DAYS

1684  
01:10:48,344 --> 01:10:53,048  
BEFORE.

1685  
01:10:53,115 --> 01:10:57,519  
>> VOYAGER TWO WE FOUND WE LOST

1686  
01:10:57,586 --> 01:11:00,522  
THE ONE RECEIVER, SO WE HAD TO

1687  
01:11:00,589 --> 01:11:05,094  
LEARN HOW TO SEND THE RIGHT

1688  
01:11:05,160 --> 01:11:06,495

FREQUENCIES, BUT THAT WAS A

1689

01:11:06,562 --> 01:11:07,997

SCARY PERIOD OF SEVERAL MONTHS

1690

01:11:08,063 --> 01:11:12,368

AS WE SORTED OUT WHAT HAPPENED.

1691

01:11:12,434 --> 01:11:14,069

WE HAD FLOWN THE ENTIRE MISSION

1692

01:11:14,136 --> 01:11:17,239

WITH THIS TONE-DEAF RECEIVER.

1693

01:11:17,306 --> 01:11:22,378

THAT'S FINE.

1694

01:11:22,444 --> 01:11:23,646

NORMALLY YOU DON'T HEAR ABOUT

1695

01:11:23,712 --> 01:11:25,814

THEM BECAUSE ONCE THEY GET FIXED

1696

01:11:25,881 --> 01:11:27,049

IT'S OLD NEWS.

1697

01:11:27,116 --> 01:11:34,490

WE'RE VERY LUCKY, BECAUSE THAT

1698

01:11:34,556 --> 01:11:38,794

IS THE RISK OF SPACE.

1699

01:11:38,861 --> 01:11:40,763

>> WE WOULD LIKE TO THANK OUR

1700

01:11:40,829 --> 01:11:42,831

SECOND PANEL FOR DOING A

1701  
01:11:42,898 --> 01:11:45,567  
WONDERFUL JOB AND GIVE US A

1702  
01:11:45,634 --> 01:11:50,305  
GREAT HISTORY AND FUTURE OF

1703  
01:11:50,372 --> 01:11:52,975  
VOYAGER PROJECT.

1704  
01:11:53,042 --> 01:11:53,475  
[APPLAUSE]

1705  
01:11:53,542 --> 01:11:57,079  
I WANT TO TURN THINGS OVER TO

1706  
01:11:57,146 --> 01:11:59,682  
ANN DRUYAN, WHO IS GOING TO

1707  
01:11:59,748 --> 01:12:01,050  
PRESENT THE FINAL PART OF OUR

1708  
01:12:01,116 --> 01:12:04,720  
DAY'S ACTIVITIES.

1709  
01:12:04,787 --> 01:12:06,388  
>> WELL, WHAT YOU SEE BEFORE YOU

1710  
01:12:06,455 --> 01:12:09,792  
UP ON THE SCREEN IS VOYAGER'S

1711  
01:12:09,858 --> 01:12:11,860  
FINAL LOOK HOMEWARD, A PICTURE

1712  
01:12:11,927 --> 01:12:14,730  
THAT WAS TAKEN BECAUSE CARL

1713  
01:12:14,797 --> 01:12:18,167

SAGAN LOBBIED ENDLESSLY TO HAVE

1714

01:12:18,233 --> 01:12:19,134

IT TAKEN.

1715

01:12:19,201 --> 01:12:21,537

IT WAS RELUCTANT TO TAKE IT

1716

01:12:21,603 --> 01:12:23,572

BECAUSE TO LOOK HOMEWARD WAS TO

1717

01:12:23,639 --> 01:12:26,208

LOOK BACK TO THE SUN, WHICH

1718

01:12:26,275 --> 01:12:28,477

MEANT THE POSSIBILITY THAT IT

1719

01:12:28,544 --> 01:12:30,713

WOULD BURN UP.

1720

01:12:30,779 --> 01:12:32,247

BUT AS CARL KEPT SAYING, WE'RE

1721

01:12:32,314 --> 01:12:34,516

NOT GOING TO TAKE ANY MORE

1722

01:12:34,583 --> 01:12:35,117

PICTURES.

1723

01:12:35,184 --> 01:12:39,054

HE KNEW THAT IT WOULD BE

1724

01:12:39,121 --> 01:12:42,991

IMPORTANT FOR US TO SEE OUR

1725

01:12:43,058 --> 01:12:46,528

WHOLE PLANET NOT AS THE

1726  
01:12:46,595 --> 01:12:50,399  
FRAME-FILLING APOLLO IMAGE WITH

1727  
01:12:50,466 --> 01:12:53,869  
SUCH A CHANGE IN THE HISTORY OF

1728  
01:12:53,936 --> 01:12:54,570  
OUR CIVILIZATION.

1729  
01:12:54,636 --> 01:12:55,771  
I REMEMBER SEEING THE EARTH FROM

1730  
01:12:55,838 --> 01:12:57,372  
SPACE FOR THE FIRST TIME, AND

1731  
01:12:57,439 --> 01:12:59,541  
SEEING IT FILL THE FRAME, AND

1732  
01:12:59,608 --> 01:13:01,243  
BELIEVING FOR THE FIRST TIME IN

1733  
01:13:01,310 --> 01:13:03,679  
THE KIND OF VISCERAL WAY, YES,

1734  
01:13:03,746 --> 01:13:07,116  
WE LIVE ON A WORLD THAT MOVES

1735  
01:13:07,182 --> 01:13:10,953  
THROUGH SPACE.

1736  
01:13:11,019 --> 01:13:18,560  
THIS IS WHAT WE REALLY NEED

1737  
01:13:18,627 --> 01:13:19,862  
RIGHT FOR THIS MOMENT.

1738  
01:13:19,928 --> 01:13:21,964

THIS IS NOT A FRAME-FILLING

1739

01:13:22,030 --> 01:13:26,869

IMAGE OF THE EARTH.

1740

01:13:26,935 --> 01:13:31,507

WE LIVE ON AN ONE PIXEL WORLD IN

1741

01:13:31,573 --> 01:13:33,976

THE SCALE OF THE SOLAR SYSTEM.

1742

01:13:34,042 --> 01:13:36,178

FORGET ABOUT TF THE

1743

01:13:36,245 --> 01:13:36,512

GALAXY.

1744

01:13:36,578 --> 01:13:39,982

FORGET ABOUT THE SCALE OF THE

1745

01:13:40,048 --> 01:13:41,083

100 BILLION GALAXIES.

1746

01:13:41,150 --> 01:13:42,718

FORGET THE PART OF THE UNIVERSE

1747

01:13:42,785 --> 01:13:44,887

THAT WE HAVE YET TO APPREHEND.

1748

01:13:44,953 --> 01:13:47,723

WE ONLY UNDERSTAND AND REALLY

1749

01:13:47,790 --> 01:13:50,959

KNOW SUCH A SMALL PART OF IT.

1750

01:13:51,026 --> 01:13:54,863

AND THAT'S REALLY US AS.

1751  
01:13:57,366 --> 01:13:59,902  
IT SHOWS US HOW WE SHOULD LIVE.

1752  
01:13:59,968 --> 01:14:08,110  
I'M SO GLAD IN A IT HAS EXCEEDED

1753  
01:14:08,177 --> 01:14:08,544  
CARL'S WISHES.

1754  
01:14:08,610 --> 01:14:14,316  
IN THE BIBLE IT SAYS SEE IT AS A

1755  
01:14:14,383 --> 01:14:14,783  
WALK.

1756  
01:14:14,850 --> 01:14:17,186  
IN THE MORNING, IN THE NIGHT, TO

1757  
01:14:17,252 --> 01:14:32,334  
SEE THAT IN SOMETHING THAT IS

1758  
01:14:32,401 --> 01:14:34,336  
WORTHY OF OUR CHILDREN AND

1759  
01:14:34,403 --> 01:14:35,103  
GRANDCHILDREN.

1760  
01:14:35,170 --> 01:14:37,472  
THANK YOU.

1761  
01:14:37,539 --> 01:14:43,278  
[APPLAUSE]

1762  
01:14:43,345 --> 01:14:43,679  
ED.

1763  
01:14:43,745 --> 01:14:45,814

>> THANK YOU TO ANN AND ALL OF

1764

01:14:45,881 --> 01:14:47,916

OUR PANELISTS AND SPEAKERS

1765

01:14:47,983 --> 01:14:48,750

TODAY.

1766

01:14:48,817 --> 01:14:51,053

ON BEHALF OF THE SPACE MUSEUM,

1767

01:14:51,119 --> 01:14:52,688

THANK YOU FOR JOINING US TODAY,