

5 YEARS



ON MARS

1
00:00:05,190 --> 00:00:03,429
green board green green

2
00:00:08,230 --> 00:00:05,200
five five

3
00:00:12,390 --> 00:00:08,240
four four four three three

4
00:00:15,030 --> 00:00:12,400
two one engine start and liftoff of the

5
00:00:18,710 --> 00:00:15,040
delta ii rocket carrying the spirit from

6
00:00:20,630 --> 00:00:19,830
three

7
00:00:22,230 --> 00:00:20,640
two

8
00:00:25,509 --> 00:00:22,240
main engine start

9
00:00:28,550 --> 00:00:25,519
zero and liftoff of the delta rocket

10
00:00:30,630 --> 00:00:28,560
with opportunity a chance to explore and

11
00:00:54,310 --> 00:00:30,640
unlock the secrets of our neighboring

12
00:00:54,320 --> 00:00:59,110
they're on mars everybody

13
00:00:59,120 --> 00:01:14,870

is

14

00:01:19,910 --> 00:01:17,749

the two landing sites are very different

15

00:01:28,390 --> 00:01:19,920

and we've used the two vehicles very

16

00:01:33,030 --> 00:01:30,870

opportunities landing site is smooth and

17

00:01:36,149 --> 00:01:33,040

flat you can drive for miles it's all

18

00:01:40,630 --> 00:01:38,390

spirits landing site is very rugged

19

00:01:41,670 --> 00:01:40,640

very rocky moving around is much more

20

00:01:43,830 --> 00:01:41,680

difficult

21

00:01:45,590 --> 00:01:43,840

a spirit's landing site is at a higher

22

00:01:47,670 --> 00:01:45,600

latitude so the winters are much more

23

00:01:49,109 --> 00:01:47,680

severe and so coaxing that vehicle

24

00:01:51,590 --> 00:01:49,119

through a cold

25

00:01:55,429 --> 00:01:51,600

uh dark martian winter is is is a much

26

00:01:57,510 --> 00:01:55,439

tougher job than it is for opportunity

27

00:01:59,749 --> 00:01:57,520

now they are well named opportunity

28

00:02:01,830 --> 00:01:59,759

really has been incredibly opportunistic

29

00:02:03,030 --> 00:02:01,840

and lucky it basically found water from

30

00:02:05,510 --> 00:02:03,040

its lander

31

00:02:09,510 --> 00:02:05,520

it's been able to do all kinds of things

32

00:02:11,750 --> 00:02:10,710

like being able to drive into these

33

00:02:13,270 --> 00:02:11,760

craters

34

00:02:15,110 --> 00:02:13,280

it found its own heat shield and we were

35

00:02:16,470 --> 00:02:15,120

able to examine for the first time a

36

00:02:17,830 --> 00:02:16,480

heat shield that was used on another

37

00:02:19,030 --> 00:02:17,840

planet because it happened to land

38

00:02:21,110 --> 00:02:19,040

nearby

39

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

spirit really has had to have a lot of

40

00:02:25,589 --> 00:02:23,840

spirit to to keep going it's been the

41

00:02:27,510 --> 00:02:25,599

little rover that could in a way it's

42

00:02:29,910 --> 00:02:27,520

had to work very hard for all of its

43

00:02:33,190 --> 00:02:29,920

discoveries these are phenomenal

44

00:02:34,710 --> 00:02:33,200

vehicles so well engineered and designed

45

00:02:36,229 --> 00:02:34,720

and built

46

00:02:38,229 --> 00:02:36,239

that they've been able to last but

47

00:02:40,309 --> 00:02:38,239

they've been able to do this very

48

00:02:42,309 --> 00:02:40,319

challenging dangerous

49

00:02:45,190 --> 00:02:42,319

uh exploration of the surface i mean

50

00:02:47,190 --> 00:02:45,200

they are very much intrepid explorers

51
00:02:48,150 --> 00:02:47,200
you know are proxies on the surface of

52
00:02:50,470 --> 00:02:48,160
mars

53
00:02:54,710 --> 00:02:50,480
um you know going forth to explore this

54
00:02:59,589 --> 00:02:56,790
mars is a nasty place

55
00:03:02,390 --> 00:02:59,599
and one of the things that mars does

56
00:03:04,229 --> 00:03:02,400
is every so often

57
00:03:06,309 --> 00:03:04,239
blows up into a global dust storm our

58
00:03:08,070 --> 00:03:06,319
third summer on mars it happened

59
00:03:10,229 --> 00:03:08,080
storm went global

60
00:03:12,470 --> 00:03:10,239
you know blocked out the sky

61
00:03:14,710 --> 00:03:12,480
if you were sitting at the surface of

62
00:03:16,630 --> 00:03:14,720
mars where where opportunity was the

63
00:03:18,869 --> 00:03:16,640

amount of direct sunlight

64

00:03:20,550 --> 00:03:18,879

hitting the solar panels was less than

65

00:03:21,750 --> 00:03:20,560

one percent

66

00:03:23,190 --> 00:03:21,760

of what it would be with a clear

67

00:03:25,350 --> 00:03:23,200

atmosphere you could barely tell where

68

00:03:26,949 --> 00:03:25,360

the sun was in the sky

69

00:03:29,350 --> 00:03:26,959

this is a very scary thing if you're a

70

00:03:32,550 --> 00:03:29,360

solar powered vehicle obviously

71

00:03:34,149 --> 00:03:32,560

and uh yeah it was it was this kind of

72

00:03:36,149 --> 00:03:34,159

helpless feeling you're sitting there

73

00:03:37,509 --> 00:03:36,159

and mars is doing what it does and it's

74

00:03:39,509 --> 00:03:37,519

you know you sit there feeling like the

75

00:03:41,350 --> 00:03:39,519

planet's trying to kill our rovers

76

00:03:43,270 --> 00:03:41,360

and we

77

00:03:46,229 --> 00:03:43,280

had this very challenging job of

78

00:03:52,789 --> 00:03:46,239

managing this this tiny amount of power

79

00:03:57,750 --> 00:03:55,910

the bad wheel on spirit has been

80

00:03:59,110 --> 00:03:57,760

both a curse and as it turns out a

81

00:04:01,110 --> 00:03:59,120

blessing

82

00:04:02,789 --> 00:04:01,120

the curse part is obvious it's very hard

83

00:04:04,630 --> 00:04:02,799

to drive that vehicle now it's spirit's

84

00:04:06,070 --> 00:04:04,640

in some pretty tough terrain anyway and

85

00:04:08,470 --> 00:04:06,080

now you're dragging this dead wheel

86

00:04:10,309 --> 00:04:08,480

through the dirt uh you know 10 meters

87

00:04:12,149 --> 00:04:10,319

is a really good day for spirit

88

00:04:14,070 --> 00:04:12,159

these days but

89

00:04:16,229 --> 00:04:14,080

it's had a wonderful silver lining these

90

00:04:18,229 --> 00:04:16,239

trenches that she would that she was uh

91

00:04:19,509 --> 00:04:18,239

uh digging that just sort of naturally

92

00:04:21,990 --> 00:04:19,519

happened by dragging a wheel through the

93

00:04:23,830 --> 00:04:22,000

dirt um had these bright patches at the

94

00:04:26,230 --> 00:04:23,840

bottom some of those patches turned out

95

00:04:28,390 --> 00:04:26,240

to have a hot very high like 90 silica

96

00:04:31,189 --> 00:04:28,400

content and the way you get a high 90

97

00:04:33,510 --> 00:04:31,199

silica content is lots of water activity

98

00:04:35,270 --> 00:04:33,520

so by dragging spirits broken wheel

99

00:04:37,030 --> 00:04:35,280

around she actually turned up some of

100

00:04:39,030 --> 00:04:37,040

the best evidence we found

101
00:04:41,670 --> 00:04:39,040
of water on either vehicle so far on

102
00:04:46,790 --> 00:04:44,230
get the victoria was great i mean it was

103
00:04:49,510 --> 00:04:46,800
21 months

104
00:04:51,510 --> 00:04:49,520
of trudging endlessly across these

105
00:04:53,590 --> 00:04:51,520
planes and hardly seeing the scenery

106
00:04:56,790 --> 00:04:53,600
change at all and then one day we're

107
00:04:59,510 --> 00:04:56,800
right at the at the rim of it and

108
00:05:01,510 --> 00:04:59,520
there's just this spectacular

109
00:05:02,950 --> 00:05:01,520
scenery this fabulous geology laid out

110
00:05:05,590 --> 00:05:02,960
in front of us and

111
00:05:07,909 --> 00:05:05,600
yeah the combination of

112
00:05:09,830 --> 00:05:07,919
just what a glorious view it was

113
00:05:10,870 --> 00:05:09,840

plus so much effort that went into

114

00:05:12,950 --> 00:05:10,880

getting there

115

00:05:14,469 --> 00:05:12,960

pulling up to the rim of victoria was to

116

00:05:17,670 --> 00:05:14,479

me one of the really special moments in

117

00:05:22,150 --> 00:05:19,029

how do i feel about the fact that it's

118

00:05:25,029 --> 00:05:22,160

going on for five years exhausted

119

00:05:26,310 --> 00:05:25,039

i mean really tired uh you know i

120

00:05:28,550 --> 00:05:26,320

thought we were gonna get maybe six

121

00:05:33,430 --> 00:05:28,560

months out of these things

122

00:05:37,270 --> 00:05:35,350

i was one of the optimists that felt the

123

00:05:39,270 --> 00:05:37,280

rovers would survive the first winter

124

00:05:40,310 --> 00:05:39,280

and that we would have an extended

125

00:05:41,830 --> 00:05:40,320

mission

126

00:05:44,150 --> 00:05:41,840

but i never thought they would last

127

00:05:47,430 --> 00:05:44,160

through three martian winters

128

00:05:49,110 --> 00:05:47,440

and continue to explore for five years i

129

00:05:50,710 --> 00:05:49,120

never in my wildest imagination believe

130

00:05:52,469 --> 00:05:50,720

it was going to go on for five years and

131

00:05:54,790 --> 00:05:52,479

give me this opportunity to see so much

132

00:05:56,390 --> 00:05:54,800

of mars and for so long and to learn so

133

00:05:58,710 --> 00:05:56,400

much about not only about the vehicles

134

00:06:00,390 --> 00:05:58,720

but about the science of mars and about

135

00:06:02,309 --> 00:06:00,400

you know the the area in which they

136

00:06:03,830 --> 00:06:02,319

landed and to just have this opportunity

137

00:06:05,350 --> 00:06:03,840

that that i thought was going to be a

138

00:06:06,950 --> 00:06:05,360

terrific little kind of short honeymoon

139

00:06:08,629 --> 00:06:06,960

just kind of go on and on and on and on

140

00:06:10,070 --> 00:06:08,639

and on and just and just get better all

141

00:06:12,150 --> 00:06:10,080

the time we're going to push these

142

00:06:14,870 --> 00:06:12,160

rovers as

143

00:06:16,629 --> 00:06:14,880

hard as we can for as long as we can

144

00:06:18,390 --> 00:06:16,639

you know as long as they keep on moving

145

00:06:20,870 --> 00:06:18,400

as long as they keep making discoveries

146

00:06:23,990 --> 00:06:20,880

it is our responsibility

147

00:06:27,430 --> 00:06:24,000

to push these vehicles until they drop

148

00:06:28,309 --> 00:06:27,440

the rovers have made mars familiar to us

149

00:06:30,230 --> 00:06:28,319

you know

150

00:06:32,950 --> 00:06:30,240

prior to their landing it was this

151
00:06:34,710 --> 00:06:32,960
mysterious place and even though it had

152
00:06:36,629 --> 00:06:34,720
successful orbiting

153
00:06:38,469 --> 00:06:36,639
missions we didn't have a human

154
00:06:40,550 --> 00:06:38,479
perspective on mars it was always a very

155
00:06:42,469 --> 00:06:40,560
distant perspective the rovers have

156
00:06:44,950 --> 00:06:42,479
given us that human perspective and now

157
00:06:46,870 --> 00:06:44,960
it is familiar to us

158
00:06:48,950 --> 00:06:46,880
mars is such a complicated place and

159
00:06:51,110 --> 00:06:48,960
these are such capable vehicles

160
00:06:53,350 --> 00:06:51,120
that there will never come a time

161
00:06:55,189 --> 00:06:53,360
when we're done

162
00:06:57,589 --> 00:06:55,199
regardless of whether when this mission

163
00:06:58,629 --> 00:06:57,599

ends whether it's tomorrow or five years

164

00:07:00,870 --> 00:06:58,639

from now

165

00:07:03,749 --> 00:07:00,880

there's always going to be some

166

00:07:06,070 --> 00:07:03,759

wonderful tantalizing thing just beyond

167

00:07:07,990 --> 00:07:06,080

our reach that we didn't quite get to

168

00:07:10,550 --> 00:07:08,000

when our children and grandchildren

169

00:07:13,110 --> 00:07:10,560

bring home that science book where it

170

00:07:15,749 --> 00:07:13,120

says you know there is evidence

171

00:07:18,550 --> 00:07:15,759

of liquid water on mars

172

00:07:22,309 --> 00:07:18,560

to know that you helped build and

173

00:07:23,589 --> 00:07:22,319

operate um and and direct the rover to

174

00:07:26,710 --> 00:07:23,599

that spot

175

00:07:28,070 --> 00:07:26,720

uh yeah that's very rewarding we're

176

00:07:28,870 --> 00:07:28,080

tired

177

00:07:30,550 --> 00:07:28,880

but

178

00:07:31,749 --> 00:07:30,560

there's just nothing more fun than

179

00:07:33,029 --> 00:07:31,759

getting up in the morning and going to

180

00:07:34,550 --> 00:07:33,039

work and

181

00:07:35,350 --> 00:07:34,560

you know seeing something nobody's ever

182

00:07:37,830 --> 00:07:35,360

seen

183

00:07:39,350 --> 00:07:37,840

before and then deciding you know all of

184

00:07:40,629 --> 00:07:39,360

us sit down together today on this

185

00:07:42,390 --> 00:07:40,639

planet to decide what's going to happen