



Ray Arvidson

1
00:00:09,430 --> 00:00:05,910
the first extraterrestrial marathon

2
00:00:11,430 --> 00:00:09,440
presented by science at nasa

3
00:00:13,749 --> 00:00:11,440
with all the fanfare about mars rover

4
00:00:16,710 --> 00:00:13,759
curiosity landing on the red planet in

5
00:00:19,750 --> 00:00:16,720
august 2012 it's easy to forget that

6
00:00:22,710 --> 00:00:19,760
there's already a rover on mars an older

7
00:00:24,790 --> 00:00:22,720
smaller cousin set to accomplish a feat

8
00:00:26,710 --> 00:00:24,800
unprecedented in the history of solar

9
00:00:29,349 --> 00:00:26,720
system exploration

10
00:00:31,669 --> 00:00:29,359
mars rover opportunity is on track to

11
00:00:33,510 --> 00:00:31,679
complete the first extraterrestrial

12
00:00:39,350 --> 00:00:33,520
marathon

13
00:00:41,350 --> 00:00:39,360

opportunity landed on mars in 2004

14

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

nasa's goal was to have the rover travel

15

00:00:45,830 --> 00:00:43,280

a meager 600 meters

16

00:00:48,709 --> 00:00:45,840

however no one knew what kind of runner

17

00:00:51,670 --> 00:00:48,719

opportunity would turn out to be

18

00:00:55,270 --> 00:00:51,680

as of july 2012 opportunity has traveled

19

00:00:57,189 --> 00:00:55,280

almost 22 miles only 4.2 short of a full

20

00:00:59,590 --> 00:00:57,199

marathon

21

00:01:01,670 --> 00:00:59,600

runner author hal higdon once said the

22

00:01:03,750 --> 00:01:01,680

marathon never ceases to be a race of

23

00:01:05,590 --> 00:01:03,760

joy a race of wonder

24

00:01:08,390 --> 00:01:05,600

that goes double for a marathon on

25

00:01:10,789 --> 00:01:08,400

another world where every mile promises

26

00:01:12,710 --> 00:01:10,799

a new discovery

27

00:01:14,710 --> 00:01:12,720

opportunities prime mission is to search

28

00:01:16,870 --> 00:01:14,720

for signs of ancient water

29

00:01:18,630 --> 00:01:16,880

today the red planet is a bone-dry

30

00:01:21,429 --> 00:01:18,640

desert with breathtakingly thin

31

00:01:24,070 --> 00:01:21,439

atmosphere conditions deadly to almost

32

00:01:26,149 --> 00:01:24,080

every known form of life on earth

33

00:01:27,749 --> 00:01:26,159

billions of years ago however things

34

00:01:29,590 --> 00:01:27,759

might have been different

35

00:01:32,230 --> 00:01:29,600

many researchers believe that mars was

36

00:01:33,270 --> 00:01:32,240

warmer wetter and friendlier to martian

37

00:01:35,590 --> 00:01:33,280

life

38

00:01:37,990 --> 00:01:35,600

opportunity's job is to search for clues

39

00:01:39,749 --> 00:01:38,000

to that ancient time

40

00:01:42,310 --> 00:01:39,759

just getting to the starting line was

41

00:01:46,149 --> 00:01:42,320

epic this particular marathoner had to

42

00:01:48,389 --> 00:01:46,159

fly about 283 million miles across space

43

00:01:50,870 --> 00:01:48,399

before being unceremoniously drop

44

00:01:53,590 --> 00:01:50,880

bounced on the martian surface says ray

45

00:01:56,230 --> 00:01:53,600

arvidsson mars exploration rover mission

46

00:01:58,310 --> 00:01:56,240

deputy principal investigator

47

00:02:01,030 --> 00:01:58,320

like many long distance runners

48

00:02:03,350 --> 00:02:01,040

opportunity likes to take it slow on a

49

00:02:05,270 --> 00:02:03,360

typical drive day the rover travels only

50

00:02:07,429 --> 00:02:05,280

50 to 100 meters

51
00:02:09,109 --> 00:02:07,439
this gives the rover time to pause and

52
00:02:11,510 --> 00:02:09,119
look for the unknown

53
00:02:14,229 --> 00:02:11,520
and take some photos along the way

54
00:02:17,030 --> 00:02:14,239
recently opportunity sent home its 100

55
00:02:19,190 --> 00:02:17,040
thousandth image a stunning panorama of

56
00:02:21,510 --> 00:02:19,200
the marscape

57
00:02:24,070 --> 00:02:21,520
opportunity first uncovered signs of

58
00:02:25,510 --> 00:02:24,080
water in deposits near the landing site

59
00:02:26,949 --> 00:02:25,520
in eagle crater

60
00:02:29,430 --> 00:02:26,959
there were rocks that seemed to have

61
00:02:31,509 --> 00:02:29,440
formed in an ancient shallow lake

62
00:02:34,150 --> 00:02:31,519
over the next four years opportunities

63
00:02:36,470 --> 00:02:34,160

scavenged ever larger and deeper craters

64

00:02:38,309 --> 00:02:36,480

finding more evidence of wet periods

65

00:02:40,150 --> 00:02:38,319

indications were however that the

66

00:02:41,830 --> 00:02:40,160

ancient lake water might have been too

67

00:02:43,670 --> 00:02:41,840

acidic for life

68

00:02:46,070 --> 00:02:43,680

the metallic marathoner soon set its

69

00:02:48,869 --> 00:02:46,080

sights on endeavour crater an enormous

70

00:02:49,750 --> 00:02:48,879

pit 14 miles wide and hundreds of meters

71

00:02:51,430 --> 00:02:49,760

deep

72

00:02:53,670 --> 00:02:51,440

endeavour's depth would offer a look

73

00:02:55,670 --> 00:02:53,680

farther back into the history of mars to

74

00:02:56,869 --> 00:02:55,680

a time when the water was possibly less

75

00:02:58,550 --> 00:02:56,879

acidic

76

00:03:00,790 --> 00:02:58,560

the marathon route crossing mars

77

00:03:04,309 --> 00:03:00,800

meridiani plane to endeavor was a daring

78

00:03:06,550 --> 00:03:04,319

trek with no aid stations anywhere

79

00:03:09,110 --> 00:03:06,560

raging dust storms reduced the rover's

80

00:03:11,509 --> 00:03:09,120

solar power so much that opportunity

81

00:03:14,070 --> 00:03:11,519

almost entered the sleep of death

82

00:03:15,589 --> 00:03:14,080

soft sandy wind-blown ripples trapped

83

00:03:18,070 --> 00:03:15,599

the rover's wheels

84

00:03:19,910 --> 00:03:18,080

and there was an injury a failure an

85

00:03:22,710 --> 00:03:19,920

opportunity's right front steering

86

00:03:24,789 --> 00:03:22,720

actuator made running forward tricky

87

00:03:26,550 --> 00:03:24,799

ever resourceful the rover ran part of

88

00:03:27,990 --> 00:03:26,560

its race backwards

89

00:03:30,229 --> 00:03:28,000
the course took opportunity over

90

00:03:32,550 --> 00:03:30,239
sedimentary bedrock made of magnesium

91

00:03:34,550 --> 00:03:32,560
iron and calcium sulfate minerals

92

00:03:36,710 --> 00:03:34,560
further indication of water billions of

93

00:03:38,229 --> 00:03:36,720
years ago says arvidsson

94

00:03:40,390 --> 00:03:38,239
when the marathoner reached endeavour

95

00:03:41,750 --> 00:03:40,400
crater in august 2011 things got

96

00:03:43,509 --> 00:03:41,760
interesting

97

00:03:45,509 --> 00:03:43,519
endeavour is surrounded by fractured

98

00:03:47,110 --> 00:03:45,519
sedimentary rock and the cracks are

99

00:03:49,190 --> 00:03:47,120
filled with gypsum

100

00:03:50,949 --> 00:03:49,200
gypsum forms when groundwater comes up

101
00:03:53,750 --> 00:03:50,959
and fills cracks in the ground

102
00:03:55,990 --> 00:03:53,760
depositing hydrated calcium sulfate

103
00:03:58,470 --> 00:03:56,000
this is the best evidence we've ever

104
00:04:00,229 --> 00:03:58,480
found for liquid water on mars

105
00:04:02,949 --> 00:04:00,239
the gypsum veins were likely formed in

106
00:04:05,110 --> 00:04:02,959
conditions more ph neutral and possibly

107
00:04:06,470 --> 00:04:05,120
more hospitable to life

108
00:04:08,949 --> 00:04:06,480
jackpot

109
00:04:11,589 --> 00:04:08,959
but this marathoner isn't done

110
00:04:13,589 --> 00:04:11,599
opportunity is doing so well that 26.2

111
00:04:14,710 --> 00:04:13,599
miles might not be the finish line after

112
00:04:16,710 --> 00:04:14,720
all

113
00:04:18,189 --> 00:04:16,720

we have no plans to stop running says

114

00:04:21,830 --> 00:04:18,199

arvidsson

115

00:04:24,150 --> 00:04:21,840

extraterrestrial ultramarathon anyone