1
00:00:08,360 --> 00:00:05,630
the hope is that we land there and we

2
00:00:09,799 --> 00:00:08,370
can basically unlock the secrets of an

3
00:00:12,259 --> 00:00:09,809
environment that existed a few billion

4
00:00:23,850 --> 00:00:12,269
years ago on Mars that was potentially a

5
00:00:29,740 --> 00:00:26,590
Mars has beckoned to earthbound

6
00:00:31,780 --> 00:00:29,750
observers for centuries seeming to

7
00:00:34,390 --> 00:00:31,790
appeal to astronomers to find out the

8
00:00:36,220 --> 00:00:34,400
secrets of the lone bright red dot among

9
00:00:39,100 --> 00:00:36,230
all the bright white stars in the

10
00:00:41,740 --> 00:00:39,110
nighttime sky those answers came

11
00:00:44,080 --> 00:00:41,750
sparingly but as technology advanced on

12
00:00:46,270 --> 00:00:44,090
earth astronomers were provided new

13
00:00:48,549 --> 00:00:46,280

tools to get better and better looks at

14
00:00:51,610 --> 00:00:48,559
the planet closest to Earth in terms of

15
00:00:54,390 --> 00:00:51,620
distance and makeup NASA put a wheeled

16
00:00:58,300 --> 00:00:54,400
robot on Mars for the first time in July

17
00:01:01,240 --> 00:00:58,310
1997 about the size of a skateboard and

18
00:01:03,250 --> 00:01:01,250
weighing 23 pounds the Sojourner showed

19
00:01:05,410 --> 00:01:03,260
Earth unprecedented views of the Red

20
00:01:07,990 --> 00:01:05,420
Planet has a rolled over the surface for

21
00:01:11,499 --> 00:01:08,000
three months all within 500 metres of

22
00:01:13,300 --> 00:01:11,509
its base station now NASA is on the

23
00:01:15,460 --> 00:01:13,310
verge of launching another Rover to

24
00:01:17,770 --> 00:01:15,470
Earth's nearest planetary neighbor when

25
00:01:20,109 --> 00:01:17,780
it is nearly 1,000 times heavier than

26
00:01:22,180 --> 00:01:20,119
Sojourner and packing a mobile

27
00:01:24,880 --> 00:01:22,190
laboratory designed to look closely at

28
00:01:27,100 --> 00:01:24,890
what the planet is made of the rover is

29
00:01:31,120 --> 00:01:27,110
called the Mars Science Laboratory or

30
00:01:33,010 --> 00:01:31,130
MSL also known as curiosity and its

31
00:01:36,160 --> 00:01:33,020
results may answer one of the great

32
00:01:37,990 --> 00:01:36,170
questions of modern science Mars and

33
00:01:40,240 --> 00:01:38,000
Earth were made at about the same time

34
00:01:42,340 --> 00:01:40,250
and yet they've had very different

35
00:01:44,830 --> 00:01:42,350
evolutionary pathways we seem to be

36
00:01:47,289 --> 00:01:44,840
verdant and full of life and Mars is

37
00:01:49,240 --> 00:01:47,299
quite cryptic so we'd like to understand

38
00:01:50,830 --> 00:01:49,250

a little bit about the past of Mars in

39
00:01:52,539 --> 00:01:50,840
fact we'd specifically like to know

40
00:01:54,969 --> 00:01:52,549
whether or not Mars has ever been

41
00:01:59,109 --> 00:01:54,979
habitable perhaps in some distant time

42
00:02:01,929 --> 00:01:59,119
perhaps now beneath the surface when it

43
00:02:04,149 --> 00:02:01,939
comes to Mars history has shown mission

44
00:02:06,249 --> 00:02:04,159
planners they cannot take any aspect of

45
00:02:09,340 --> 00:02:06,259
the launched flight or landing for

46
00:02:11,949 --> 00:02:09,350
granted NASA the Russians and Soviets

47
00:02:13,990 --> 00:02:11,959
and the European Space Agency all lost

48
00:02:16,539 --> 00:02:14,000
missions to the red planet at one time

49
00:02:19,050 --> 00:02:16,549
or other it is tough to land on Mars

50
00:02:25,000 --> 00:02:19,060
sometimes it's even tough to orbit Mars

51
00:02:29,010 --> 00:02:25,010
so Mars is difficult anytime you're

52
00:02:35,100 --> 00:02:32,150
and you're making that transition from

53
00:02:38,339 --> 00:02:35,110
not only orbiting and taking pictures

54
00:02:42,479 --> 00:02:38,349
but add the complexity of slowing

55
00:02:47,479 --> 00:02:42,489
yourself down putting a target on that

56
00:02:50,190 --> 00:02:47,489
planet and landing there that's awesome

57
00:02:51,960 --> 00:02:50,200
launches to Mars also come with a strict

58
00:02:55,530 --> 00:02:51,970
time limit when the planets are aligned

59
00:02:57,870 --> 00:02:55,540
correctly to allow a flight for MSL we

60
00:03:00,890 --> 00:02:57,880
only get an opportunity every 24 to 26

61
00:03:03,300 --> 00:03:00,900
months if you miss it you have to wait

62
00:03:06,059 --> 00:03:03,310
curiosity is to begin its flight to Mars

63
00:03:09,240 --> 00:03:06,069

packed inside the nose cone of an Atlas

64
00:03:11,280 --> 00:03:09,250
5 rocket will fly through space for nine

65
00:03:13,490 --> 00:03:11,290
months before beginning its work on the

66
00:03:16,320 --> 00:03:13,500
surface in August 2012

67
00:03:17,850 --> 00:03:16,330
like every mission of Mars this one

68
00:03:19,979 --> 00:03:17,860
carries the most advanced tools

69
00:03:23,190 --> 00:03:19,989
available to conduct experiments on its

70
00:03:25,530 --> 00:03:23,200
own millions of miles from Earth and

71
00:03:27,809 --> 00:03:25,540
then the real new thing for this Rover

72
00:03:30,240 --> 00:03:27,819
is the ability to actually drill in to

73
00:03:32,550 --> 00:03:30,250
rocks on Mars collect powder from those

74
00:03:35,039 --> 00:03:32,560
rocks and deliver that powder to two

75
00:03:37,349 --> 00:03:35,049
relatively large analytical chemistry

76
00:03:39,720 --> 00:03:37,359
laboratories that are located inside the

77
00:03:41,670 --> 00:03:39,730
rover itself so we deliver that powder

78
00:03:43,440 --> 00:03:41,680
and we can uniquely determine its

79
00:03:45,360 --> 00:03:43,450
mineralogy what minerals are present as

80
00:03:47,190 --> 00:03:45,370
well as what chemical elements are

81
00:03:48,960 --> 00:03:47,200
present and this will really give the

82
00:03:50,910 --> 00:03:48,970
scientists the core information they

83
00:03:52,979 --> 00:03:50,920
need to figure out whether Mars was a

84
00:03:54,960 --> 00:03:52,989
habitable environment though Rover is

85
00:03:57,479 --> 00:03:54,970
essentially like a geologist and a

86
00:03:59,670 --> 00:03:57,489
self-contained laboratory and the

87
00:04:01,559 --> 00:03:59,680
capabilities that exist are probably the

88
00:04:03,930 --> 00:04:01,569

next best thing to sending a human

89
00:04:06,330 --> 00:04:03,940
astronaut to do the same job he will

90
00:04:08,670 --> 00:04:06,340
also be back remarkable views from the

91
00:04:13,349 --> 00:04:08,680
surface using state-of-the-art cameras

92
00:04:17,110 --> 00:04:13,359
including 3d lenses this is a vehicle on

93
00:04:19,539 --> 00:04:17,120
Mars cruising around

94
00:04:22,240 --> 00:04:19,549
drilling into rocks chipping away at

95
00:04:25,360 --> 00:04:22,250
stuff to see what that planets made out

96
00:04:27,129 --> 00:04:25,370
of and even if it didn't do that if it

97
00:04:29,680 --> 00:04:27,139
just cruised around Mars and took

98
00:04:32,620 --> 00:04:29,690
pictures that the value and that is

99
00:04:35,470 --> 00:04:32,630
tremendous curiosity is not headed to

100
00:04:37,330 --> 00:04:35,480
just anywhere the Red Planet scientist

101
00:04:39,730 --> 00:04:37,340
spent years searching for the best place

102
00:04:41,950 --> 00:04:39,740
to land the rover somewhere that had the

103
00:04:45,610 --> 00:04:41,960
best chance to show the true past and

104
00:04:48,430 --> 00:04:45,620
present of Mars that place is called

105
00:04:50,590 --> 00:04:48,440
Gale Crater a three mile high mountain

106
00:04:52,659 --> 00:04:50,600
stands in the center of the crater and

107
00:04:54,490 --> 00:04:52,669
curiosity will explore the sediments

108
00:04:56,560 --> 00:04:54,500
that have built up there and hopes that

109
00:04:59,200 --> 00:04:56,570
the soil will complete parts of the

110
00:05:01,570 --> 00:04:59,210
Martian puzzle and what special about

111
00:05:02,980 --> 00:05:01,580
Gale is has the thickest package of

112
00:05:05,920 --> 00:05:02,990
sediment that we've been able to

113
00:05:08,500 --> 00:05:05,930

identify on Mars so it represents a lot

114
00:05:11,070 --> 00:05:08,510
of time and hopefully we'll get some

115
00:05:14,680 --> 00:05:11,080
idea about what has happened over time

116
00:05:16,629 --> 00:05:14,690
if Mars was ever home to vast lakes and

117
00:05:19,210 --> 00:05:16,639
flowing rivers which data from other

118
00:05:22,950 --> 00:05:19,220
spacecraft suggests then the rocks and

119
00:05:26,170 --> 00:05:22,960
minerals at Gale Crater could reveal

120
00:05:28,930 --> 00:05:26,180
unimaginable Ana Terry neighbor they

121
00:05:30,370 --> 00:05:28,940
suggest in a tantalizing way that

122
00:05:33,010 --> 00:05:30,380
perhaps they could have been deposited

123
00:05:35,469 --> 00:05:33,020
underwater and of course we associate

124
00:05:37,870 --> 00:05:35,479
water often with the possibility the

125
00:05:40,180 --> 00:05:37,880
potential for habitability it's an

126
00:05:42,279 --> 00:05:40,190
ambitious mission and the robot designed

127
00:05:45,520 --> 00:05:42,289
to pull it off is unlike any planetary

128
00:05:48,370 --> 00:05:45,530
Rovers devised so far my first thought

129
00:05:50,890 --> 00:05:48,380
and I won't lie was Wow it's a very

130
00:05:53,860 --> 00:05:50,900
impressive spacecraft the rover itself

131
00:05:58,779 --> 00:05:53,870
is much larger than anything that we've

132
00:06:00,610 --> 00:05:58,789
set up before but it's a very very very

133
00:06:02,140 --> 00:06:00,620
impressive spacecraft and we're looking

134
00:06:02,930 --> 00:06:02,150
forward to some great science coming out

135
00:06:04,700 --> 00:06:02,940
of the MS

136
00:06:08,450 --> 00:06:04,710
we couldn't use airbags as time because

137
00:06:10,310 --> 00:06:08,460
of the weight of curiosity so we went

138
00:06:11,930 --> 00:06:10,320

back to using Rockets but the novel

139
00:06:14,240 --> 00:06:11,940
design is this little rocket jetpack

140
00:06:16,130 --> 00:06:14,250
that that flies the rover down and then

141
00:06:18,170 --> 00:06:16,140
lowers the rover down on a tether lands

142
00:06:20,540 --> 00:06:18,180
it on the ground and then that rocket

143
00:06:23,180 --> 00:06:20,550
jetpack flies off and we're done with it

144
00:06:26,350 --> 00:06:23,190
that leaves the rover ready to Rove

145
00:06:29,030 --> 00:06:26,360
around on its wheels and explore Mars

146
00:06:31,070 --> 00:06:29,040
relying on solar cells was ruled

147
00:06:33,860 --> 00:06:31,080
insufficient for a mission as ambitious

148
00:06:35,180 --> 00:06:33,870
as the Mars Science Laboratory simply

149
00:06:38,120 --> 00:06:35,190
put they did not provide enough

150
00:06:39,920 --> 00:06:38,130
electricity for a year-round mission nor

151
00:06:42,080 --> 00:06:39,930
would they produce enough power for the

152
00:06:43,940 --> 00:06:42,090
10 instruments on the rover some of

153
00:06:47,150 --> 00:06:43,950
which have to operate at the same time

154
00:06:49,520 --> 00:06:47,160
to fulfill their research goals the

155
00:06:51,740 --> 00:06:49,530
rover may cover 12 miles or more during

156
00:06:55,370 --> 00:06:51,750
its 23 month mission the goal that

157
00:06:57,470 --> 00:06:55,380
requires a steady amount of power so the

158
00:06:59,360 --> 00:06:57,480
Department of Energy built for NASA a

159
00:07:01,190 --> 00:06:59,370
nuclear-powered electrical system

160
00:07:04,040 --> 00:07:01,200
instead called a multi-mission

161
00:07:07,580 --> 00:07:04,050
radioisotope thermoelectric generator or

162
00:07:09,800 --> 00:07:07,590
in them RTG it has no moving parts but

163
00:07:12,620 --> 00:07:09,810

converts heat from a small core of

164
00:07:14,870 --> 00:07:12,630
plutonium into about 110 watts of

165
00:07:17,900 --> 00:07:14,880
electricity around-the-clock and all

166
00:07:20,300 --> 00:07:17,910
year it's the same power source that

167
00:07:22,850 --> 00:07:20,310
enables probes to work in deep space on

168
00:07:25,760 --> 00:07:22,860
missions such as Galileo's examination

169
00:07:28,070 --> 00:07:25,770
of Jupiter Cassini's unprecedented look

170
00:07:30,200 --> 00:07:28,080
at Saturn and the New Horizons mission

171
00:07:32,840 --> 00:07:30,210
to Pluto and the farthest boundary of

172
00:07:35,560 --> 00:07:32,850
the solar system it was also used on the

173
00:07:39,350 --> 00:07:35,570
surface of Mars by the Viking landers in

174
00:07:42,380 --> 00:07:39,360
1976 NASA also takes extra precautions

175
00:07:44,360 --> 00:07:42,390
because of the power supply including

176
00:07:46,670 --> 00:07:44,370
working with other federal agencies to

177
00:07:49,540 --> 00:07:46,680
ensure its safety on earth and during

178
00:07:54,620 --> 00:07:52,190
looking up Mars through a telescope over

179
00:07:57,620 --> 00:07:54,630
the decades astronomers have wondered

180
00:07:59,300 --> 00:07:57,630
what secrets the planet conceals even

181
00:08:01,760 --> 00:07:59,310
looking at the surface doesn't tell the

182
00:08:04,220 --> 00:08:01,770
whole story which is why scientists have

183
00:08:07,250 --> 00:08:04,230
been eager to dig deeper every time they

184
00:08:10,700 --> 00:08:07,260
get a chance those folks that actually

185
00:08:13,160 --> 00:08:10,710
had a hand on role in building this

186
00:08:16,400 --> 00:08:13,170
thing there's some separation anxiety

187
00:08:19,460 --> 00:08:16,410
I'd bet you but now the next phase is

188
00:08:22,130 --> 00:08:19,470

hey I get to drive this thing or I get

189
00:08:27,050 --> 00:08:22,140
to used a hammer drill on something so

190
00:08:28,880 --> 00:08:27,060
that aspect of it is great I've been

191
00:08:32,180 --> 00:08:28,890
working on Mars Science Laboratory for

192
00:08:34,969 --> 00:08:32,190
seven years and I'm extremely excited

193
00:08:36,469 --> 00:08:34,979
that we're getting ready to launch 20

194
00:08:38,330 --> 00:08:36,479
years from now I think they'll look back

195
00:08:41,360 --> 00:08:38,340
and consider this a true landmark

196
00:08:43,790 --> 00:08:41,370
mission a great stepping stone for human

197
00:08:45,020 --> 00:08:43,800
exploration beyond Earth orbit and it

198
00:08:46,980 --> 00:08:45,030
will certainly be one for the history