



1
00:00:03,160 --> 00:00:04,000
>> Pat Ryan: Our mission

2
00:00:04,000 --> 00:00:06,440
to the International Space
Station is not the only thing

3
00:00:06,440 --> 00:00:08,250
that NASA is doing of course.

4
00:00:08,250 --> 00:00:11,020
In fact, we're now
less than one week away

5
00:00:11,020 --> 00:00:13,650
from the next Mars landing.

6
00:00:13,650 --> 00:00:18,210
NASA's Mars Science Laboratory
with the rover Curiosity is due

7
00:00:18,210 --> 00:00:19,740
to land on Mars early

8
00:00:19,740 --> 00:00:22,560
in the morning next
Monday August the 6th.

9
00:00:22,560 --> 00:00:25,200
You're going to be seeing more
coverage of the MSL mission

10
00:00:25,200 --> 00:00:28,070
on NASA Television as we
get closer to landing.

11
00:00:28,070 --> 00:00:31,000
That'll include features from
the Jet Propulsion Laboratory

12

00:00:31,000 --> 00:00:34,450
in California, which manages
the mission, as well as here

13

00:00:34,450 --> 00:00:36,390
at the Johnson Space
Center in Houston,

14

00:00:36,390 --> 00:00:38,100
where some of the members

15

00:00:38,100 --> 00:00:41,620
of the Mars Science Laboratory
team are located and one

16

00:00:41,620 --> 00:00:43,560
of them is here with
us today to talk

17

00:00:43,560 --> 00:00:45,170
about the goals of that mission.

18

00:00:45,170 --> 00:00:48,900
Dr. Doug Archer is a fellow in
NASA's post doctoral program

19

00:00:48,900 --> 00:00:53,240
and a member of the Sample
Analysis at Mars Science Team.

20

00:00:53,240 --> 00:00:55,310
Doug let's tell me first

21

00:00:55,310 --> 00:00:58,620
of all how long have you
been a part of the SAM team?

22

00:00:58,620 --> 00:01:00,280

>> Dr. Doug Archer: Well I've been a part of the SAM team

23

00:01:00,280 --> 00:01:04,350
for a little bit over two years now and I got involved

24

00:01:04,350 --> 00:01:08,230
by working with some Mars scientists here at JSC

25

00:01:08,230 --> 00:01:11,480
and I knew that they were involved in MSL and came

26

00:01:11,480 --> 00:01:14,760
out here to JSC to work with them and to work on MSL.

27

00:01:14,760 --> 00:01:17,020
>> Pat: This isn't even your first trip to Mars;

28

00:01:17,020 --> 00:01:18,500
I think that's pretty cool.

29

00:01:18,500 --> 00:01:21,930
You were part of a previous landing on Mars team right?

30

00:01:21,930 --> 00:01:24,680
>> Dr. Archer: Yeah I had the amazing experience to work

31

00:01:24,680 --> 00:01:29,550
as a science team member on the 2008 Phoenix Mars Scout Mission

32

00:01:29,550 --> 00:01:32,960
that landed on the northern

plains of Mars a few years ago

33

00:01:32,960 --> 00:01:37,490
and I was able to help
participate in the buildup

34

00:01:37,490 --> 00:01:40,880
to the mission and then landed
ops and things like looking

35

00:01:40,880 --> 00:01:43,660
at sample acquisition and how
to get a sample and where to dig

36

00:01:43,660 --> 00:01:47,060
for a sample and we're actually
still involved here at JSC

37

00:01:47,060 --> 00:01:49,530
and analyzing some of the
data that we're returned

38

00:01:49,530 --> 00:01:52,080
by the [inaudible]
instrument on Phoenix,

39

00:01:52,080 --> 00:01:56,620
which as mass spectrometer that
has some capabilities similar

40

00:01:56,620 --> 00:01:58,900
to that of the SAM
instrument on MSL.

41

00:01:58,900 --> 00:02:02,280
>> Pat: Is landing on Mars
all we might imagine it to be?

42

00:02:02,280 --> 00:02:04,800
>> Dr. Archer: I've got

to say it's probably one

43

00:02:04,800 --> 00:02:06,470
of the most exciting
thing that's ever happened

44

00:02:06,470 --> 00:02:07,210
to me in my life.

45

00:02:07,210 --> 00:02:11,740
It's a nerve raking few
minutes but incredibly exciting.

46

00:02:11,740 --> 00:02:14,820
>> Pat: The MSL mission
has got some big goals.

47

00:02:14,820 --> 00:02:16,150
Can you summarize it for us?

48

00:02:16,150 --> 00:02:20,190
What is MSL intending
to find or to learn?

49

00:02:20,190 --> 00:02:22,910
>> Dr. Archer: Yeah so in
one word its habitability.

50

00:02:22,910 --> 00:02:27,500
MSL is trying to analyze and
investigate the habitability

51

00:02:27,500 --> 00:02:30,570
of our landing site and when I
say habitability I'm not talking

52

00:02:30,570 --> 00:02:34,730
about looking for life per
say, really it's looking

53

00:02:34,730 --> 00:02:37,340

for an environment where
life could survive,

54

00:02:37,340 --> 00:02:39,550

where life could be ok.

55

00:02:39,550 --> 00:02:43,290

Either at some point in the
past on Mars or maybe up even

56

00:02:43,290 --> 00:02:46,870

to today but again it's
looking for habitability,

57

00:02:46,870 --> 00:02:51,470

not for life itself and it
does that by using its suite

58

00:02:51,470 --> 00:02:54,320

of ten instruments which look
at things like the geology,

59

00:02:54,320 --> 00:02:57,730

the geochemistry, the radiation
environment and a whole host

60

00:02:57,730 --> 00:02:59,770

of other factors which
are really interesting in

61

00:02:59,770 --> 00:03:03,470

and of themselves but together
they can paint a really complete

62

00:03:03,470 --> 00:03:07,250

picture of if this environment
is somewhere where life

63

00:03:07,250 --> 00:03:08,880
as we know it could
have survived

64
00:03:08,880 --> 00:03:12,580
in the past or possibly today.

65
00:03:12,580 --> 00:03:13,990
>> Pat: That would
lead one to think

66
00:03:13,990 --> 00:03:16,440
that there's something
special about the landing site

67
00:03:16,440 --> 00:03:19,460
that you've chosen, that you
think there's something there

68
00:03:19,460 --> 00:03:20,850
that you need to go see.

69
00:03:20,850 --> 00:03:22,210
>> Dr. Archer: Yeah
so we're landing

70
00:03:22,210 --> 00:03:25,710
in a place called Gale
Crater but the first criteria

71
00:03:25,710 --> 00:03:27,960
for any landing site
is it has to be safe,

72
00:03:27,960 --> 00:03:31,050
that's the number one priority
because it's really difficult

73
00:03:31,050 --> 00:03:34,100
to do science on the surface of

Mars if you don't land safely

74

00:03:34,100 --> 00:03:35,660

so that's your number
one priority

75

00:03:35,660 --> 00:03:38,580

but it's also very interesting
from a scientific perspective.

76

00:03:38,580 --> 00:03:41,030

Again we're landing at the
bottom of this large crater,

77

00:03:41,030 --> 00:03:44,770

Gale Crater and when we land
we think we might be on top

78

00:03:44,770 --> 00:03:48,130

of some material that's been
moved down from the crater walls

79

00:03:48,130 --> 00:03:49,950

and so even though we don't
really have the intention

80

00:03:49,950 --> 00:03:52,460

to go see the crater walls
themselves cause they're

81

00:03:52,460 --> 00:03:54,940

so far away, we might get
a little glimpse of what's

82

00:03:54,940 --> 00:03:57,770

in them just because they're
going to be there where we land.

83

00:03:57,770 --> 00:03:59,390

>> Pat: How big a crater

are we talking about it?

84

00:03:59,390 --> 00:04:03,460
>> Dr. Archer: Its about
150 km or 110 or 120 miles

85

00:04:03,460 --> 00:04:08,210
across so this is a very
large impact crater and then

86

00:04:08,210 --> 00:04:10,650
after we land as we
look around we're going

87

00:04:10,650 --> 00:04:15,250
to see this huge mountain
that's 5 km or 3 miles high

88

00:04:15,250 --> 00:04:18,860
in the center of the crater
and its made up of these layers

89

00:04:18,860 --> 00:04:20,740
that were laid down
over millions of years

90

00:04:20,740 --> 00:04:24,440
of Martian history so as we
move away from our landing site

91

00:04:24,440 --> 00:04:26,790
and we drive towards
and ultimately

92

00:04:26,790 --> 00:04:32,470
up onto this mountain, we'll
be investigating hundreds

93

00:04:32,470 --> 00:04:34,750
of millions of years

of Martian history

94

00:04:34,750 --> 00:04:38,340

>> Pat: and investigating the area between the landing site

95

00:04:38,340 --> 00:04:39,610

and the mountain all along the way.

96

00:04:39,610 --> 00:04:42,680

>> Dr. Archer: Yeah we you know we're the science team is

97

00:04:42,680 --> 00:04:46,070

whenever we see something interesting it's easy

98

00:04:46,070 --> 00:04:48,580

to get distracted so you see something fun,

99

00:04:48,580 --> 00:04:49,950

you want to go fun and different,

100

00:04:49,950 --> 00:04:52,170

you want to go see what it is and one of the great things

101

00:04:52,170 --> 00:04:55,010

about exploring Mars or exploring anywhere really is

102

00:04:55,010 --> 00:04:57,450

that it is exploration and you find something new

103

00:04:57,450 --> 00:05:01,130

and unexpected every time

you go and that's really part

104

00:05:01,130 --> 00:05:04,790

of the fun and the
reward of doing this.

105

00:05:04,790 --> 00:05:07,090

>> Pat: Cause right now you
don't know what you don't know.

106

00:05:07,090 --> 00:05:07,870

>> Dr. Archer: Exactly.

107

00:05:07,870 --> 00:05:10,080

I mean you know everybody
comes up with good ideas

108

00:05:10,080 --> 00:05:12,120

of what you think you're going
to see when you get there

109

00:05:12,120 --> 00:05:14,400

but every single time
we've been surprised.

110

00:05:14,400 --> 00:05:17,430

>> Pat: You mentioned that
you were part of the SAM team;

111

00:05:17,430 --> 00:05:21,040

tell me about the components
of that instrument and what it

112

00:05:21,040 --> 00:05:23,000

in particular is going
to be looking for.

113

00:05:23,000 --> 00:05:25,920

>> Dr. Archer: Yeah so Sam
is the main goal is to look

114

00:05:25,920 --> 00:05:29,380
for organic molecules but
we're also going to be looking

115

00:05:29,380 --> 00:05:31,830
for inorganic molecules that
could tell you something

116

00:05:31,830 --> 00:05:33,570
about which minerals
are there and both

117

00:05:33,570 --> 00:05:36,810
of those things really tell you
a lot about the habitability

118

00:05:36,810 --> 00:05:41,240
of the site and SAM at its heart
is a gas analysis instrument

119

00:05:41,240 --> 00:05:45,520
so the first thing that you have
to do is get a sample of gas

120

00:05:45,520 --> 00:05:48,170
to analyze and there's one
of two ways to do that.

121

00:05:48,170 --> 00:05:51,950
The first and the easiest is
just to open up the instruments

122

00:05:51,950 --> 00:05:55,160
of the atmosphere, take a
sniff, measure the composition

123

00:05:55,160 --> 00:05:58,180
of the Martian atmosphere
and see what's there.

124

00:05:58,180 --> 00:06:03,650

The second is MSL can deliver a sample of rock or soil to SAM.

125

00:06:03,650 --> 00:06:05,890

SAM takes the sample and can heat it up to

126

00:06:05,890 --> 00:06:09,100

about 1000 degrees Celsius and as you're heating

127

00:06:09,100 --> 00:06:11,300

up the sample it's giving off gas.

128

00:06:11,300 --> 00:06:12,800

Things like if there are organics

129

00:06:12,800 --> 00:06:15,330

in the sample those will start to come off

130

00:06:15,330 --> 00:06:17,010

and some minerals also will break

131

00:06:17,010 --> 00:06:20,550

down both below a 1000 degrees and so you can get a good idea

132

00:06:20,550 --> 00:06:23,670

of what's in the sample so then you have that gas

133

00:06:23,670 --> 00:06:26,900

and SAM analyzes it using one of three instruments

134

00:06:26,900 --> 00:06:30,270

within the instrument which
are the mass spectrometer,

135

00:06:30,270 --> 00:06:33,770

the gas chromatograph and the
tunable laser spectrometer

136

00:06:33,770 --> 00:06:36,220

and the mass spectrometer
tells you what molecules are

137

00:06:36,220 --> 00:06:38,940

in the gas, the gas
chromatograph can be used

138

00:06:38,940 --> 00:06:42,550

if you have a really complicated
organic signal it can help tease

139

00:06:42,550 --> 00:06:45,060

apart what's there so you
get a better understanding

140

00:06:45,060 --> 00:06:46,120

of what's in your sample.

141

00:06:46,120 --> 00:06:47,500

>> Pat: Tease apart
the molecules?

142

00:06:47,500 --> 00:06:48,650

>> Dr. Archer: The organics yeah

143

00:06:48,650 --> 00:06:52,490

so if you say you have a big
clump of organics that comes off

144

00:06:52,490 --> 00:06:55,880
at some temperature, the
gas chromatograph will help

145

00:06:55,880 --> 00:06:58,590
to separate those based on
the properties of the organics

146

00:06:58,590 --> 00:07:02,290
so you can get a better
idea so it kind of it kind

147

00:07:02,290 --> 00:07:05,710
of slows things down I guess
so you can get a better idea

148

00:07:05,710 --> 00:07:08,600
of what's there, a better
understanding of what's there

149

00:07:08,600 --> 00:07:13,830
and then the tunable laser
spectrometer is an instrument

150

00:07:13,830 --> 00:07:15,570
that's looking for three things.

151

00:07:15,570 --> 00:07:19,060
Carbon dioxide, water
and methane

152

00:07:19,060 --> 00:07:21,340
and it can very sensitively
measure the abundance

153

00:07:21,340 --> 00:07:24,800
of those three things and it
also measures the isotopes

154

00:07:24,800 --> 00:07:28,070

of those different molecules
and that's really important

155

00:07:28,070 --> 00:07:29,840

because for example
with water is

156

00:07:29,840 --> 00:07:34,220

if you measured the isotopic
ratio of water deuterium

157

00:07:34,220 --> 00:07:35,480

and hydrogen in the atmosphere

158

00:07:35,480 --> 00:07:37,930

that it can actually tell you
something about the history

159

00:07:37,930 --> 00:07:43,040

of water throughout on Mars,
throughout the history of Mars.

160

00:07:43,040 --> 00:07:44,820

>> Pat: Not just in
that location on Mars.

161

00:07:44,820 --> 00:07:46,370

>> Dr. Archer: Yeah because
you're looking at the atmosphere

162

00:07:46,370 --> 00:07:48,300

and the atmosphere is you
know pretty well mixed,

163

00:07:48,300 --> 00:07:51,010

it can tell you something
about Mars as a whole

164

00:07:51,010 --> 00:07:52,980

over very long time periods.

165

00:07:52,980 --> 00:07:54,410

>> Pat: Help clarify
for those of us

166

00:07:54,410 --> 00:07:57,570

who did really poorly
in science.

167

00:07:57,570 --> 00:07:59,840

When you talk about organic
molecules are you talking

168

00:07:59,840 --> 00:08:04,040

about molecules from things that
are alive or once were alive?

169

00:08:04,040 --> 00:08:07,800

>> Dr. Archer: Yeah so again MSL
isn't a life detection mission

170

00:08:07,800 --> 00:08:09,870

so it's not going to be
able to answer the question

171

00:08:09,870 --> 00:08:12,860

about whether these things
were ever alive or not,

172

00:08:12,860 --> 00:08:16,110

but organic molecules are
the chemical building blocks

173

00:08:16,110 --> 00:08:18,920

of life, they're things
like amino acids and sugars,

174

00:08:18,920 --> 00:08:22,390

things that are absolutely
necessary to life as we know it.

175

00:08:22,390 --> 00:08:26,280

However, there are also
non-biological processes

176

00:08:26,280 --> 00:08:29,630

that can produce these
organic molecules so just

177

00:08:29,630 --> 00:08:32,830

because you detect an organic
molecule that doesn't mean

178

00:08:32,830 --> 00:08:36,720

that there was necessarily
life so what MSL is going

179

00:08:36,720 --> 00:08:39,950

to do again is detecting these
organics we can say ah that's an

180

00:08:39,950 --> 00:08:43,410

habitable environment and
that's going to help us to know

181

00:08:43,410 --> 00:08:45,310

where to look for
life in the future.

182

00:08:45,310 --> 00:08:48,530

>> Pat: Habitable whether
or not it was habitated.

183

00:08:48,530 --> 00:08:49,980

>> Dr. Archer: Right
inhabited, yes, yes.

184

00:08:49,980 --> 00:08:51,680

>> Pat: Thank you very much.

185

00:08:51,680 --> 00:08:53,950

We often talk about
life as we know it.

186

00:08:53,950 --> 00:08:57,170

Is it possible that there
is life there but it is

187

00:08:57,170 --> 00:08:59,080

so different than what we know

188

00:08:59,080 --> 00:09:01,770

that we don't recognize
the evidence of it?

189

00:09:01,770 --> 00:09:04,340

>> Dr. Archer: Yeah so this
is something that comes

190

00:09:04,340 --> 00:09:08,270

up in the astrobiology community
all the time you know how do you

191

00:09:08,270 --> 00:09:10,900

look for something that you
don't know what you're looking

192

00:09:10,900 --> 00:09:14,750

for so the approach that we take
is say you know right now it's

193

00:09:14,750 --> 00:09:18,610

hard enough to detect life as
we know it let's start there

194

00:09:18,610 --> 00:09:23,940

but certainly it's possible that
Mars or life could surprise us

195

00:09:23,940 --> 00:09:27,010
and we're always open
to that possibility

196
00:09:27,010 --> 00:09:30,060
but we'll see what
Mars gives us.

197
00:09:30,060 --> 00:09:32,620
>> Pat: The notes indicate
that the SAM work some

198
00:09:32,620 --> 00:09:35,040
of the work that's being done
here in Houston has to do

199
00:09:35,040 --> 00:09:37,650
with volatile bearing minerals.

200
00:09:37,650 --> 00:09:40,180
Tell me what those
are what would

201
00:09:40,180 --> 00:09:41,730
that tell you if you found that?

202
00:09:41,730 --> 00:09:44,090
>> Dr. Archer: So a volatile
bearing mineral is something

203
00:09:44,090 --> 00:09:48,850
like a carbonate or a sulfate
or a phyllosilicate, or a clay

204
00:09:48,850 --> 00:09:50,680
and those are important
because they are minerals

205
00:09:50,680 --> 00:09:53,580
that are produced when other

rocks or minerals are broken

206

00:09:53,580 --> 00:09:56,580
down and they generally
imply the presence of water

207

00:09:56,580 --> 00:09:58,470
so carbonate, for example,

208

00:09:58,470 --> 00:10:02,340
will form when you have carbon
dioxide reacting with atoms

209

00:10:02,340 --> 00:10:05,620
of calcium or magnesium, for
example, from another rock

210

00:10:05,620 --> 00:10:07,880
and again it implies
the presence of water

211

00:10:07,880 --> 00:10:11,720
and it requires a certain water
chemistry so that's important

212

00:10:11,720 --> 00:10:14,480
because just by looking
at a rock if you measure

213

00:10:14,480 --> 00:10:16,650
if you detect a carbonate
you can say something

214

00:10:16,650 --> 00:10:19,010
about how much water was
there when it formed.

215

00:10:19,010 --> 00:10:21,990
What the chemistry of that water
might have been it tells you

216

00:10:21,990 --> 00:10:24,090
something about how
much CO2 might have been

217

00:10:24,090 --> 00:10:26,060
in the atmosphere, which
has important implications

218

00:10:26,060 --> 00:10:28,820
for climate, so you can
learn all of those things

219

00:10:28,820 --> 00:10:34,330
about the history of that rock,
or the history of the site just

220

00:10:34,330 --> 00:10:36,250
by looking at a rock
it's pretty incredible.

221

00:10:36,250 --> 00:10:37,690
>> Pat: And SAM has
the instruments

222

00:10:37,690 --> 00:10:40,120
that is able to do all of those.

223

00:10:40,120 --> 00:10:43,140
>> Dr. Archer: Yes in concert
with other instruments on MSL,

224

00:10:43,140 --> 00:10:45,820
it really is an integrated
science package

225

00:10:45,820 --> 00:10:49,390
or science payload that by
themselves the instruments are

226

00:10:49,390 --> 00:10:52,390

pretty incredible but together
you can tell a very complete

227

00:10:52,390 --> 00:10:54,660

story of the landing site.

228

00:10:54,660 --> 00:10:56,890

>> Pat: I mentioned earlier
that this mission is managed

229

00:10:56,890 --> 00:11:00,470

at the Jet Propulsion Laboratory
are you going to be able to go

230

00:11:00,470 --> 00:11:02,420

out there for part of the
mission or do you do all

231

00:11:02,420 --> 00:11:03,870

of your work here in Houston?

232

00:11:03,870 --> 00:11:05,670

>> Dr. Archer: So for
the first 90 days a lot

233

00:11:05,670 --> 00:11:08,780

of the science team is going
to be co-located at JPL

234

00:11:08,780 --> 00:11:09,850

and I will be out there

235

00:11:09,850 --> 00:11:12,780

for about 4 weeks of
the first 90 days.

236

00:11:12,780 --> 00:11:17,480

After that, the science team

which goes home goes back

237

00:11:17,480 --> 00:11:19,030
to their home institutions,

238

00:11:19,030 --> 00:11:22,660
which is located throughout the
country and even internationally

239

00:11:22,660 --> 00:11:24,910
and so the rest of the mission
and the prime mission is

240

00:11:24,910 --> 00:11:27,190
for two years, we'll be done

241

00:11:27,190 --> 00:11:28,950
with the science
team being remote

242

00:11:28,950 --> 00:11:31,780
but those first 90 days a lot
of the science team will be

243

00:11:31,780 --> 00:11:34,570
out at JPL working on
Mars time together.

244

00:11:34,570 --> 00:11:38,620
>> Pat: What will you be
doing while you're there?

245

00:11:38,620 --> 00:11:41,490
>> Dr. Archer: We plan every day
we plan what the rover is going

246

00:11:41,490 --> 00:11:45,020
to do the next day so
you come in the morning

247

00:11:45,020 --> 00:11:47,840

and your shift starts
essentially right before you get

248

00:11:47,840 --> 00:11:50,290

data from the rover, everything
that it did the day before

249

00:11:50,290 --> 00:11:53,600

so you come in and you brush
up on ok what were we supposed

250

00:11:53,600 --> 00:11:56,510

to have done today and then the
rover said hey here's what I

251

00:11:56,510 --> 00:11:59,860

did, you look at all that data
and then you talk as a team

252

00:11:59,860 --> 00:12:02,330

and say ok what are we
going to do tomorrow

253

00:12:02,330 --> 00:12:04,640

and so you spend two shifts

254

00:12:04,640 --> 00:12:08,980

over about 16 hours building
a product that you're going

255

00:12:08,980 --> 00:12:12,130

to send to the space craft
that tells it what to do what

256

00:12:12,130 --> 00:12:14,250

to do tomorrow and then
you just you know repeat

257

00:12:14,250 --> 00:12:16,050
that for two years.

258

00:12:16,050 --> 00:12:18,490
>> Pat: Because of the distance
between the two planets,

259

00:12:18,490 --> 00:12:20,920
you've got quite a lag
in communications does

260

00:12:20,920 --> 00:12:25,090
that remove any flexibility
you have about what

261

00:12:25,090 --> 00:12:28,170
to tell your instruments
or your rover to do?

262

00:12:28,170 --> 00:12:31,950
>> Dr. Archer: Well that's right
because of the light time delay

263

00:12:31,950 --> 00:12:33,090
and the complexity

264

00:12:33,090 --> 00:12:35,350
of the instruments you don't
really have the flexibility

265

00:12:35,350 --> 00:12:39,630
to make changes in real time,
you plan things a day at a time

266

00:12:39,630 --> 00:12:42,810
but landing is a really
good example of that.

267

00:12:42,810 --> 00:12:46,060
So from the time that MSL

hits the top of the atmosphere

268

00:12:46,060 --> 00:12:48,530
to the time that it lands
safely on the surface

269

00:12:48,530 --> 00:12:53,410
of Mars is 7 minutes, now the
light time delay between earth

270

00:12:53,410 --> 00:12:56,360
and mars right now so the time
that it takes a signal traveling

271

00:12:56,360 --> 00:13:00,450
at the speed of light to go from
Mars to the earth is 14 minutes

272

00:13:00,450 --> 00:13:03,470
so what that means is when
we get our first indication

273

00:13:03,470 --> 00:13:07,110
that we've touched the top of
the atmosphere here on earth,

274

00:13:07,110 --> 00:13:09,900
in reality the space craft has
already been on the surface

275

00:13:09,900 --> 00:13:13,630
of Mars for 7 minutes so
really you're kind of looking

276

00:13:13,630 --> 00:13:16,190
at a tape delay of events,
you don't have the opportunity

277

00:13:16,190 --> 00:13:20,190
to respond to things in real

time and then again the way

278

00:13:20,190 --> 00:13:23,890
that that plays out during
operations is that we do most

279

00:13:23,890 --> 00:13:27,480
of our communications via the
orbiters around Mars right now,

280

00:13:27,480 --> 00:13:30,510
which only communicate with
the lander a few times a day

281

00:13:30,510 --> 00:13:33,570
so we have to uplink
a product once a day

282

00:13:33,570 --> 00:13:35,810
and we say here's what you're
going to do for every minute

283

00:13:35,810 --> 00:13:38,900
of this day coming up and
then it goes out and tries

284

00:13:38,900 --> 00:13:41,680
to do its best to
follow our instructions.

285

00:13:41,680 --> 00:13:44,370
If we did a good job
everything will go as planned

286

00:13:44,370 --> 00:13:48,190
and the next morning
when we come in we find

287

00:13:48,190 --> 00:13:50,030
out how we did and

we go from there.

288

00:13:50,030 --> 00:13:51,870

>> Pat: And found out
if there were any issues

289

00:13:51,870 --> 00:13:54,720

that it encountered while it
was trying to execute the plan

290

00:13:54,720 --> 00:13:55,130

>> Dr. Archer: Yes

291

00:13:55,130 --> 00:13:58,840

>> Pat: and then do something
about it the next day.

292

00:13:58,840 --> 00:14:00,590

>> Dr. Archer: That's right.

293

00:14:00,590 --> 00:14:03,720

>> Pat: Based on what you guys
all know already and the things

294

00:14:03,720 --> 00:14:07,010

that your team's investigating,
what are your hypotheses

295

00:14:07,010 --> 00:14:11,630

about the habitability of Mars?

296

00:14:11,630 --> 00:14:14,320

>> Dr. Archer: Well
you know I think based

297

00:14:14,320 --> 00:14:18,290

on what we know right now,
there's kind of some positives

298

00:14:18,290 --> 00:14:22,330
and negatives about
possible habitability of Mars

299

00:14:22,330 --> 00:14:25,090
that we have some missions that
for example we've seen a lot

300

00:14:25,090 --> 00:14:28,230
of evidence for water on
Mars either in the past

301

00:14:28,230 --> 00:14:31,580
or even continuing up
today from the water rise

302

00:14:31,580 --> 00:14:33,770
that the Phoenix
lander has found

303

00:14:33,770 --> 00:14:37,440
or the evidence the abundance
evidence of past water

304

00:14:37,440 --> 00:14:39,290
that the Mars rovers
have found and a lot

305

00:14:39,290 --> 00:14:42,780
of orbital measurements that
have indicated the past activity

306

00:14:42,780 --> 00:14:47,030
of water and possibly continuing
up to present day so that makes

307

00:14:47,030 --> 00:14:49,400
that encourages you about
the possibilities for life

308

00:14:49,400 --> 00:14:52,420
because water is very important,
it's absolutely necessary

309
00:14:52,420 --> 00:14:54,250
to life as we know it but then

310
00:14:54,250 --> 00:14:57,680
on the other hand the Viking
mission showed us the Viking

311
00:14:57,680 --> 00:15:00,610
actually did carry life
detection instruments with it

312
00:15:00,610 --> 00:15:02,890
and didn't find anything
so it shows us

313
00:15:02,890 --> 00:15:05,090
that the surface can also
be a pretty hostile place,

314
00:15:05,090 --> 00:15:08,420
it's a harsh UV environment,
you have ionizing radiation,

315
00:15:08,420 --> 00:15:10,690
chemical oxidants
that can destroy life

316
00:15:10,690 --> 00:15:15,490
so it can be a harsh place but
interestingly enough it's a lot

317
00:15:15,490 --> 00:15:17,000
of the things that
we've learned about life

318
00:15:17,000 --> 00:15:20,920

on earth have informed our
knowledge of the possibility

319

00:15:20,920 --> 00:15:23,810
for life on Mars and life on
earth is really ubiquitous,

320

00:15:23,810 --> 00:15:28,500
it's anywhere you go, it's
you know an extremely acidic

321

00:15:28,500 --> 00:15:32,000
or salty environments, deep
undersea, deep underground

322

00:15:32,000 --> 00:15:34,910
in solid rock and so
right now there's nothing

323

00:15:34,910 --> 00:15:37,770
about there's nothing about
what we know about life,

324

00:15:37,770 --> 00:15:40,380
which has proven itself to
be very adaptable and nothing

325

00:15:40,380 --> 00:15:42,590
that we know about
Mars that tells you

326

00:15:42,590 --> 00:15:44,270
that you can't have life there.

327

00:15:44,270 --> 00:15:46,680
You just have to know where to
look and that's the question

328

00:15:46,680 --> 00:15:48,470
that MSL is going to answer.

329

00:15:48,470 --> 00:15:50,650

>> Pat: It's all very
exciting, looking forward to it.

330

00:15:50,650 --> 00:15:51,770

Thanks very much Doug.

331

00:15:51,770 --> 00:15:53,650

Dr. Doug Archer is a member