
InSight
EDL
Jim
Bridenstine

1
00:00:04,130 --> 00:00:09,420
Welcome to "Watch This Space." I'm NASA Administrator Jim Bridenstine and NASA

2
00:00:09,420 --> 00:00:14,099
is going forward to the Moon. This time we're doing it differently than we've

3
00:00:14,099 --> 00:00:19,260
ever done it before. Recently, NASA announced nine commercial partners that

4
00:00:19,260 --> 00:00:23,820
will take NASA payloads to the surface of the Moon. These are highlights from

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00:00:23,820 --> 00:00:28,619
that recent announcement. Not only are we announcing today a number of very

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00:00:28,619 --> 00:00:32,669
innovative companies that are going to go to the Moon for the first time

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00:00:32,669 --> 00:00:35,850
commercially. In other words, we're going to buy the service. We're not going to

8
00:00:35,850 --> 00:00:39,420
purchase own and operate the hardware. We're gonna buy the service, but we're

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00:00:39,420 --> 00:00:45,629
also announcing a change that I think is important for NASA and that is this is a

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00:00:45,629 --> 00:00:52,500
response to the science community who has for a long time decided that we

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00:00:52,500 --> 00:00:56,430
needed to do science on the surface of
the Moon and yet NASA for a long time

12
00:00:56,430 --> 00:01:00,570
has focused the Moon within the human
exploration and operations Mission

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00:01:00,570 --> 00:01:04,769
Directorate and not the Science Mission
Directorate but now we're changing that.

14
00:01:04,769 --> 00:01:10,680
We believe there is a lot of amazing
science that we can do on the surface of

15
00:01:10,680 --> 00:01:14,640
the Moon. In fact, science that we can't
do anywhere other than the surface of

16
00:01:14,640 --> 00:01:21,780
the Moon. We want multiple providers that
are competing on cost and innovation so

17
00:01:21,780 --> 00:01:26,250
that we as NASA can do more than we've
ever been able to do before and advance

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00:01:26,250 --> 00:01:30,540
the human spirit science and human
exploration go together and we should

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00:01:30,540 --> 00:01:34,220
not be surprised that I'm standing here
as a scientist really excited about

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00:01:34,220 --> 00:01:40,890
exploring this celestial body right next
door to us. The Moon, like any other body

21
00:01:40,890 --> 00:01:46,189
in the solar system, the Moon is full of secrets that we don't know yet. For

22
00:01:46,189 --> 00:01:51,810
example, if you really want to decide what the h's of the solar system just

23
00:01:51,810 --> 00:01:56,009
like you look at the rings of a tree when you cut it if you want to learn

24
00:01:56,009 --> 00:02:02,119
that you go to the moon and you analyze the samples that are there

25
00:02:18,880 --> 00:02:22,900
today we are at the Jet Propulsion Laboratory the Charles elachi Mission

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00:02:22,900 --> 00:02:26,980
Control Center where we had the opportunity to participate in the Mars

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00:02:26,980 --> 00:02:32,140
insight Lander I am here with Emily manor Chapman who is an instrument

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00:02:32,140 --> 00:02:36,280
engineer on the Mars insight Lander and of course today we've had a very

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00:02:36,280 --> 00:02:41,530
exciting day and in fact a very successful day her part in this was the

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00:02:41,530 --> 00:02:45,910
development of instruments that have been you know not just engineered but

31
00:02:45,910 --> 00:02:50,380
built and now delivered to the surface
of Mars so congratulations on a

32
00:02:50,380 --> 00:02:54,280
wonderful day thank you so much
definitely so exciting today that's so

33
00:02:54,280 --> 00:02:58,720
great tell me what is the instrument
package that you worked on I work with

34
00:02:58,720 --> 00:03:02,530
what we call the auxilary payload sensor
suite which is a collection of

35
00:03:02,530 --> 00:03:06,310
environmental or weather sensors oh so
we have a sensor that can measure air

36
00:03:06,310 --> 00:03:09,940
temperature wind speed atmospheric
pressure and also a magnetometer that

37
00:03:09,940 --> 00:03:14,280
can measure the magnetic field at Mars
so tell us are we gonna get like

38
00:03:14,280 --> 00:03:21,160
continuous updates on the weather you
know on Mars we will starting this week

39
00:03:21,160 --> 00:03:23,950
we'll do a short check out with the
instrument just to make sure everything

40
00:03:23,950 --> 00:03:27,100
is working correctly after landing if
that's successful then we'll turn on the

41
00:03:27,100 --> 00:03:30,190
instrument and it basically stays on
almost continuously at that point so we

42
00:03:30,190 --> 00:03:34,990
will get a full Sol's worth of weather
data every Saul how long is it going to

43
00:03:34,990 --> 00:03:39,370
take before there's a number of
instruments here and of course your your

44
00:03:39,370 --> 00:03:43,660
package is one of many instruments
that's right there's a seismometer on

45
00:03:43,660 --> 00:03:47,290
the mars insight Lander and there's
something called the mole let's let's

46
00:03:47,290 --> 00:03:50,320
talk about the seismometer first what is
that gonna help us understand

47
00:03:50,320 --> 00:03:54,910
so the seismometer will measure quakes
on Mars or Mars quakes as we call them

48
00:03:54,910 --> 00:03:59,350
okay and by looking at the type of
seismic activity on Mars will tell us

49
00:03:59,350 --> 00:04:02,740
something about how Mars formed and what
it's made of so scientists can look at

50
00:04:02,740 --> 00:04:06,730
the waves and data picked up by the
instrument tell us about how do seismic

51
00:04:06,730 --> 00:04:09,580
waves move through the material on Mars
and looking at how they move what

52
00:04:09,580 --> 00:04:14,310
and I've been told that it can even pick
up like maybe even micro meteor

53
00:04:14,310 --> 00:04:17,950
meteorites that actually hit the surface
of Mars even on the other side of the

54
00:04:17,950 --> 00:04:20,650
planet yeah that's correct we think
we'll be able to detect those as well

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00:04:20,650 --> 00:04:25,960
wow that's fantastic so okay the mole
tell me about the mole so the purpose of

56
00:04:25,960 --> 00:04:31,990
the mole is to measure how heat changes
and moves around inside of Mars so the

57
00:04:31,990 --> 00:04:35,770
mole is kind of a big nail about the
size of my forearm and it can actually

58
00:04:35,770 --> 00:04:39,730
hammer itself underneath the surface of
Mars and so with the mole we're gonna go

59
00:04:39,730 --> 00:04:43,330
deeper underneath the surface of Mars
and any other mission has before will go

60
00:04:43,330 --> 00:04:48,250
down - up to about 15 feet and trailing
behind that mole will be a series of

61
00:04:48,250 --> 00:04:52,150
temperature sensors and so it will be
able to take temperature over time and

62
00:04:52,150 --> 00:04:55,360
again see how the heat is moving around
how is it changing inside Mars and again

63
00:04:55,360 --> 00:04:57,910
that tells us something about how Mars
formed and what it's made of

64
00:04:57,910 --> 00:05:02,890
amazing tell me what do you know about
the core of Mars well first if you look

65
00:05:02,890 --> 00:05:06,910
at the at our core here on earth we know
that we have a kind of molten metallic

66
00:05:06,910 --> 00:05:10,120
core and that core is what drives the
magnetic field that we have here at

67
00:05:10,120 --> 00:05:13,900
Earth and so as you said we don't see
that mobile magnetic field anymore at

68
00:05:13,900 --> 00:05:18,580
Mars so we want to find out is the core
liquid or is it solid and what does it

69
00:05:18,580 --> 00:05:21,940
made of because if we see something it's
like maybe it's a solid core so you

70
00:05:21,940 --> 00:05:25,510
don't have that dynamo action in the
center of the planet like we do your

71
00:05:25,510 --> 00:05:28,780
hair so we don't have anything to drive
that magnetic field of Earth and so

72
00:05:28,780 --> 00:05:31,690
we're actually gonna use radio signals
between a radio signal between the

73
00:05:31,690 --> 00:05:34,990
lander on Mars and an antenna here on
earth looking at changes in that radio

74
00:05:34,990 --> 00:05:39,970
signal will tell us about what the core
is made of is it solid or is it so how

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00:05:39,970 --> 00:05:44,950
long until we start getting some you
know really serious science data from

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00:05:44,950 --> 00:05:47,919
insight it will actually be about two to
three months because the next thing that

77
00:05:47,919 --> 00:05:53,050
we need to do with insight is so we're
on the surface but as we when we landed

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00:05:53,050 --> 00:05:56,530
all of our science instruments are
sitting up on top of the lander and we

79
00:05:56,530 --> 00:06:00,070
really want to get our seismometer onto
the ground because it's gonna take much

80
00:06:00,070 --> 00:06:03,520
better data if it's actually in contact
with the Martian surface and for our

81
00:06:03,520 --> 00:06:05,890
probe obviously it also needs to be on
the ground cuz we wanted to hambar

82
00:06:05,890 --> 00:06:09,460
underneath the surface so the next two
to three months we're gonna spend using

83
00:06:09,460 --> 00:06:12,430
the robotic arm and the robotic arm you
could think of like one of those

84
00:06:12,430 --> 00:06:15,610
carnival games with the claw and you go
and pick stuff up and put it on the

85
00:06:15,610 --> 00:06:18,580
ground and that's basically robotic arm
has a have little claw and you go pick

86
00:06:18,580 --> 00:06:21,120
up the instruments and set them onto the
ground so

87
00:06:21,120 --> 00:06:23,940
in the neck then the coming a couple
weeks we're gonna be looking out where

88
00:06:23,940 --> 00:06:27,930
did B land taking lots of images to see
what's in front of the Lander picking

89
00:06:27,930 --> 00:06:30,600
where do we want to put the seismometer
where do we want to put the mole and

90
00:06:30,600 --> 00:06:34,199
then actually start that process of
using the robotic arm to pick up those

91
00:06:34,199 --> 00:06:37,650
instruments and get them onto the
surface of Mars amazing well Emily thank

92
00:06:37,650 --> 00:06:41,340
you for your great work what an amazing
accomplishment today we're all so proud

93
00:06:41,340 --> 00:06:45,780
of you and your entire team here at the
Jet Propulsion Laboratory and of course

94
00:06:45,780 --> 00:06:51,620
the insight team so thank you so much
for your great work thank you absolutely

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00:06:52,060 --> 00:06:56,210
well I'm here with Vivian son who is a
systems engineer here at the Jet

96
00:06:56,210 --> 00:06:59,960
Propulsion Laboratory and she has been
involved in picking the landing site for

97
00:06:59,960 --> 00:07:05,990
the Mars 2020 Rover which of course is a
mission happening in 2020 and we're all

98
00:07:05,990 --> 00:07:11,090
very excited about that so tell us what
goes into selecting a landing site on

99
00:07:11,090 --> 00:07:16,160
Mars for the 2020 Rover right so
actually this process began several

100
00:07:16,160 --> 00:07:20,960
years ago so it first started in 2013
when an open call was put out to the

101
00:07:20,960 --> 00:07:25,520
Mars community basically saying that
anyone who wishes to propose a landing

102
00:07:25,520 --> 00:07:29,660
site for this Mars 2020 mission can do
so and the only requirements are that

103
00:07:29,660 --> 00:07:34,070
this landing site had to demonstrate
that there used to be liquid water at

104
00:07:34,070 --> 00:07:40,700
this site and that this liquid water had
a chemistry that could have supported

105
00:07:40,700 --> 00:07:45,770
life had it existed on Mars at that time
and so with those requirements the first

106
00:07:45,770 --> 00:07:49,910
landing site workshop was held in 2013
and there were about 30 years so

107
00:07:49,910 --> 00:07:53,180
landings like candidates that were put
forth by different members of the

108
00:07:53,180 --> 00:07:57,080
community and so at the workshop we
discussed the pros and cons of each site

109
00:07:57,080 --> 00:08:00,440
would each site had to offer what kind
of samples we might collect at every

110
00:08:00,440 --> 00:08:04,880
site and so in this sort of fashion
we've had several more landing site

111
00:08:04,880 --> 00:08:08,510
workshops we just concluded with the
fourth and final one this past fall just

112
00:08:08,510 --> 00:08:12,590
about a month ago
and throughout that process that initial

113
00:08:12,590 --> 00:08:16,580
list of 30 landing site candidates was
eventually whittled down to the three

114
00:08:16,580 --> 00:08:20,810
that we had just a month ago which is of
course jezero crater northeast syrtis

115
00:08:20,810 --> 00:08:27,110
and Columbia Hills and so at the
conclusion of the final landing site we

116
00:08:27,110 --> 00:08:31,340
discussed again the pros and cons of
every location what a kind of mission

117
00:08:31,340 --> 00:08:35,270
might look like to each of those sites
and then we came out with jezero crater

118
00:08:35,270 --> 00:08:39,650
you mentioned that the water was
critically important as the the maybe

119
00:08:39,650 --> 00:08:43,190
maybe the the the type of chemicals that
would have been in that water that may

120
00:08:43,190 --> 00:08:47,510
have been able to help support life and
and that's what went into this selection

121
00:08:47,510 --> 00:08:52,160
process so what we're actually going to
do is cache samples on the surface of

122
00:08:52,160 --> 00:08:57,080
Mars with the Mars 2020 Rover what what
do we get when we cache samples why do

123
00:08:57,080 --> 00:08:59,910
we do that so the reason why we've
really

124
00:08:59,910 --> 00:09:04,230
to cache samples with Mars 2020 and the
reason why this is such a critical step

125
00:09:04,230 --> 00:09:09,720
for Mars sample return and understanding
the history of Mars and its potential

126
00:09:09,720 --> 00:09:14,220
for ancient life the reason is because
even though our Rovers are incredibly

127
00:09:14,220 --> 00:09:18,690
sophisticated on the surface of Mars
they're still limited compared to the

128
00:09:18,690 --> 00:09:22,230
analyses that we could do here on earth
in our laboratories where we have access

129
00:09:22,230 --> 00:09:27,510
to the most the state-of-the-art
technologies and so to really look at

130
00:09:27,510 --> 00:09:32,370
them sample to look at a rock and be
able to tell whether something is the

131
00:09:32,370 --> 00:09:36,210
true bio signature or whether it's
something that was truly evidence for

132
00:09:36,210 --> 00:09:39,870
past life you really need to do that
kind of analysis here on earth with our

133
00:09:39,870 --> 00:09:45,600
sophisticated labs yeah yeah so the idea
is Mars 2020 just passes a sample then

134
00:09:45,600 --> 00:09:49,770
we have to do a Mars sample return
mission which of course we don't have a

135
00:09:49,770 --> 00:09:53,520
date for yet but in my view we need to
do it as soon as possible to get those

136
00:09:53,520 --> 00:09:58,350
samples back to earth and at the end of
it the goal is to discover whether or

137
00:09:58,350 --> 00:10:05,040
not Mars is habitable or maybe at one
time was habitable or even today

138
00:10:05,040 --> 00:10:10,020
could it have life is that the intent
here yeah so for sure we want to

139
00:10:10,020 --> 00:10:13,710
understand whether the environments that
we're investigating were habitable or

140
00:10:13,710 --> 00:10:18,300
not and from the satellite data or the
orbital data that we have we have pretty

141
00:10:18,300 --> 00:10:22,140
good hints that there probably habitable
that they used to have water and that

142
00:10:22,140 --> 00:10:26,850
that water had chemistry that could have
supported life if it existed there but

143
00:10:26,850 --> 00:10:33,330
what we don't know is if there was life
that's one question if there was life do

144
00:10:33,330 --> 00:10:38,220
we have evidence that preserves for
example fossils or other bio signatures

145
00:10:38,220 --> 00:10:42,320
do we have that evidence that there was
past life in any of these

146
00:10:42,320 --> 00:10:45,889
that's something that we can only figure
out by returning those samples back okay

147
00:10:45,889 --> 00:10:49,550
well Vivian I want to tell you we're
grateful for your work we're looking

148
00:10:49,550 --> 00:10:54,829
forward to coming back 26 months from
now and we have a a successful Mars 2020

149
00:10:54,829 --> 00:10:59,600
landing on the surface of Mars and we'll
we'll revisit this again and talk more

150
00:10:59,600 --> 00:11:04,639
in depth about what the next steps are
so thank you so much and Mars is a

151
00:11:04,639 --> 00:11:12,620
wonderful place we need to learn more
thank you you bet we now have an

152
00:11:12,620 --> 00:11:17,089
opportunity to meet Mimi um who of
course has been highly involved in

153
00:11:17,089 --> 00:11:23,600
what's called Mars helicopter so when we
said Mars 2020 to Mars in 2020 of course

154
00:11:23,600 --> 00:11:27,709
it's not only going to have the rover
it's also going to have attached to the

155
00:11:27,709 --> 00:11:32,839
rover a helicopter that Mimi has been
involved in developing now for many

156
00:11:32,839 --> 00:11:39,529
years as a matter of fact over four
years so tell me how did this come to

157
00:11:39,529 --> 00:11:43,880
your mind as an idea was it was it out
there before was it your brainchild had

158
00:11:43,880 --> 00:11:48,649
it how did this come into being no a
feasibility of helicopters flying at

159
00:11:48,649 --> 00:11:54,620
Mars have been proven in the early in
the 90s okay in fact Bob elrom who's the

160
00:11:54,620 --> 00:11:58,970
chief engineer on our project he had
done research in those days showing that

161
00:11:58,970 --> 00:12:02,810
you know feasible it's possible there's
enough atmosphere to lift fly a

162
00:12:02,810 --> 00:12:06,949
helicopter the challenge of course is it
has to be very light yeah

163
00:12:06,949 --> 00:12:12,529
similarly over in Ames you Larry Young
has some research that have been proven

164
00:12:12,529 --> 00:12:17,569
but the thing that had not made it
possible until recently is the

165
00:12:17,569 --> 00:12:22,550
availability of technologies with these
lightweight capable flying vehicles okay

166
00:12:22,550 --> 00:12:29,540
so around 2012 or so our previous
director Charles elachi was on a lab

167
00:12:29,540 --> 00:12:34,010
tour and he will see these drones being
used to demonstrate autonomous

168
00:12:34,010 --> 00:12:38,120
navigation algorithms and after the Tory
said hey why don't we do this at Mars

169
00:12:38,120 --> 00:12:44,149
Wow and so we connected him back in fact
I happened to be on the bus in his tour

170
00:12:44,149 --> 00:12:47,850
because he was visiting our division
autonomous systems division and I was

171
00:12:47,850 --> 00:12:51,899
deputy divisions manager of autonomous
systems division at the time anyway so

172
00:12:51,899 --> 00:12:57,060
so why don't we do this so we connected
him back to Bob Bell Ram who had done

173
00:12:57,060 --> 00:13:02,430
research in the 90s and then he started
from there okay so maybe tell me why is

174
00:13:02,430 --> 00:13:07,290
it important to have a helicopter on
Mars today we explore planets from

175
00:13:07,290 --> 00:13:12,060
spacecraft in orbit and Rovers on the
surface but we're not using the aerial

176
00:13:12,060 --> 00:13:18,120
dimension to explore surfaces so the
helicopter would open doors to exploring

177
00:13:18,120 --> 00:13:21,509
you know exploration through aerial
dimension yeah

178
00:13:21,509 --> 00:13:27,269
and that will help with forward
reconnaissance far ahead of Rovers or in

179
00:13:27,269 --> 00:13:32,069
the future astronauts right astronauts
are there to explore and so for

180
00:13:32,069 --> 00:13:35,279
reconnaissance is very important and
it's a new dimension secondly we'll be

181
00:13:35,279 --> 00:13:39,360
able to get to places we simply can't
get to today right right and and even in

182
00:13:39,360 --> 00:13:43,139
the future with Rovers or even
astronauts for example you know sites of

183
00:13:43,139 --> 00:13:46,740
these cliffs right recently there are
these exposed ice carps that have you

184
00:13:46,740 --> 00:13:51,180
know we would have to fly there to get a
sample and analyze them on Leonard

185
00:13:51,180 --> 00:13:57,509
assets or bottom of crevasses and steep
volcanoes yeah a new dimension adding it

186
00:13:57,509 --> 00:14:02,519
so so when the Mars 2020 rover lands the
helicopter will be underneath it is that

187
00:14:02,519 --> 00:14:07,470
correct that's right and then it will be
released it will unfold and then it will

188
00:14:07,470 --> 00:14:12,959
take off how long will it be able to fly
we plan to do incremental series of

189
00:14:12,959 --> 00:14:16,769
flights so the first thing we would want
to do is repeat the flights that we have

190
00:14:16,769 --> 00:14:21,810
demonstrated in Mars like atmospheric
density in our 25-foot chamber here all

191
00:14:21,810 --> 00:14:25,350
right so that would be the first flight
we'll want to do you exactly what we

192
00:14:25,350 --> 00:14:30,689
have modeled and demonstrated on earth
and so we will go up and hover and come

193
00:14:30,689 --> 00:14:36,630
down go up to 3 meters so I want to take
a moment when you lift off of Mars and

194
00:14:36,630 --> 00:14:42,329
then set down on Mars what do you think
that moment will be like I would if you

195
00:14:42,329 --> 00:14:47,100
yeah if I dare say so it would be just
like a rights brother moment yeah really

196
00:14:47,100 --> 00:14:52,829
because flying in this thin atmosphere
is it just hasn't been done before

197
00:14:52,829 --> 00:14:57,630
yeah so it's Ordinary tell me about the
atmosphere we compared it to earth what

198
00:14:57,630 --> 00:15:01,060
is what is it has
it's very thin so compared to earth less

199
00:15:01,060 --> 00:15:05,440
than 1% of Earth's atmospheric density
so we have algorithms that show that we

200
00:15:05,440 --> 00:15:10,660
can fly we can control but too real and
we have done experiments on earth in our

201
00:15:10,660 --> 00:15:15,790
chamber but to definitively demonstrate
doing this on Mars it's the huge master

202
00:15:15,790 --> 00:15:20,620
will be and ok so as you mentioned you
have your Wright brothers moment where

203
00:15:20,620 --> 00:15:24,850
you actually take off the surface of
another world and then land again with a

204
00:15:24,850 --> 00:15:28,870
helicopter okay then after that what's
the next test that you want to do then

205
00:15:28,870 --> 00:15:33,400
we'll start doing incrementally further
lateral flight so we'll ascend and then

206
00:15:33,400 --> 00:15:38,200
go laterally start with modestly with a
few tens of meters and they come back

207
00:15:38,200 --> 00:15:43,870
and land and then after that you know
falling incrementally further up to 150

208
00:15:43,870 --> 00:15:49,390
meters or so out and back okay and that
would fully confirm all the models all

209
00:15:49,390 --> 00:15:54,520
the assumptions that we've done in and
can definitively include what it's it's

210
00:15:54,520 --> 00:15:58,270
weird to think about because when you're
in atmosphere that's that thin as you

211
00:15:58,270 --> 00:16:02,080
mentioned less than 1% of Earth's
atmosphere it seems like once you start

212
00:16:02,080 --> 00:16:07,210
going it becomes very difficult to stop
so everything it has to be so much more

213
00:16:07,210 --> 00:16:12,880
precise the way the way you start moving
requires a certain you know a certain

214
00:16:12,880 --> 00:16:17,860
amount of you know L over D in order to
tilt the helicopter and move it but then

215
00:16:17,860 --> 00:16:22,420
you have to be able to stop it but the
atmosphere is sufficiently thin is does

216
00:16:22,420 --> 00:16:27,640
it does it scale is it comparable to
Earth's atmosphere I mean it seems like

217
00:16:27,640 --> 00:16:32,440
it's far more complicated than it is
what normal people might think that it

218
00:16:32,440 --> 00:16:38,620
is yes it's very counterintuitive the
thin atmosphere reacts the the blase

219
00:16:38,620 --> 00:16:42,040
reactive friendly with the thin
atmosphere for example their residence

220
00:16:42,040 --> 00:16:47,080
resonances in all rotorcraft you know
and on earth very with very thick

221
00:16:47,080 --> 00:16:51,310
atmosphere a lot of the resonances get
dampened out sure within atmosphere they

222
00:16:51,310 --> 00:16:55,210
continue ring so for example our
development our test demonstration and

223
00:16:55,210 --> 00:16:58,930
the design and the selection of
frequencies have to be very carefully

224
00:16:58,930 --> 00:17:04,329
aligned and be aware of those reaction
of the vehicle while it's a thin

225
00:17:04,329 --> 00:17:08,809
atmosphere response is actually slower
in

226
00:17:08,809 --> 00:17:12,529
since and faster than others so for
example you know you turn the blade and

227
00:17:12,529 --> 00:17:16,220
here on atmosphere you are pushing so
much air you suddenly turn right there

228
00:17:16,220 --> 00:17:21,379
it takes a little longer so definitely
our team had had to model from the very

229
00:17:21,379 --> 00:17:27,139
fundamentals of a blade
taking a blade that's you know where 1.2

230
00:17:27,139 --> 00:17:33,830
meter diameter blades so rotor system so
1/2 a point 6 meter or so per blade we

231
00:17:33,830 --> 00:17:39,470
actually had to cut into 33 virtual
pieces and analyze them for the lift and

232
00:17:39,470 --> 00:17:44,029
the drag of each of the piece well you
know with the high fidelity CFD analysis

233
00:17:44,029 --> 00:17:49,190
take the lift and drag integrated them
and then model how the dynamics of the

234
00:17:49,190 --> 00:17:54,200
vehicle would be in this thin atmosphere
these little Reynolds numbers and this

235
00:17:54,200 --> 00:17:57,529
is you know low density area you're
starting from scratch starting from

236
00:17:57,529 --> 00:18:03,649
scratch and it's been a surprise nice
surprise and it's made it very fun yeah

237
00:18:03,649 --> 00:18:07,429
but definitely starting from the
fundamental right so that's why when you

238
00:18:07,429 --> 00:18:10,639
asked us now about how would you feel
what does it mean that very first like

239
00:18:10,639 --> 00:18:19,190
to unconditionally confirm our models in
the real environment fantastic first of

240
00:18:19,190 --> 00:18:23,299
its kind it'll be monumental we're so
looking forward to seeing it happen and

241
00:18:23,299 --> 00:18:27,980
of course it's gonna be part of the Mars
2020 Rover so it's really not that far

242
00:18:27,980 --> 00:18:31,610
away we're almost there
and we look forward to coming back here

243
00:18:31,610 --> 00:18:37,909
in 26 months in order to watch a very
safe and effective Mars 2020 lander and

244
00:18:37,909 --> 00:18:42,950
thereafter a Mars helicopter take off
and land on the surface of another world

245
00:18:42,950 --> 00:18:47,389
for the first time in human history
Thank You Mimi um for all of your great

246
00:18:47,389 --> 00:18:53,600
work thank you and waiting to see all of
your accomplishments in the future

247
00:18:53,600 --> 00:18:58,440
well thank you for watching watch this
space I'm NASA Administrator Jim

248
00:18:58,440 --> 00:19:03,420
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at jim bridenstine and of course if you