
The
Changing Face
of
MARS

1
00:00:03,750 --> 00:00:06,283
- Hello, I'm John Fitch.

2
00:00:07,440 --> 00:00:09,280
Man, since the beginning of time,

3
00:00:09,280 --> 00:00:12,040
has wondered about the
stars and the planets.

4
00:00:12,040 --> 00:00:13,440
Our neighbor planet Mars

5
00:00:13,440 --> 00:00:17,000
has intrigued the imagination
of artists and writers.

6
00:00:17,000 --> 00:00:19,438
Some people think there is life on Mars.

7
00:00:19,438 --> 00:00:22,010
- [Male Voice] I see a
vast network of channels

8
00:00:22,010 --> 00:00:23,700
crisscrossing the planet.

9
00:00:23,700 --> 00:00:26,600
Obviously, the work of
intelligent Martians.

10
00:00:26,600 --> 00:00:28,400
The simplicity and symmetry cannot-

11
00:00:28,400 --> 00:00:30,790
- [Male Voice] It will be
possible with larger telescopes

12

00:00:30,790 --> 00:00:32,870
to see cities on Mars,

13
00:00:32,870 --> 00:00:35,040
to detect navies in its harbors.

14
00:00:35,040 --> 00:00:36,542
- [Male Voice] The inhabitants of Mars

15
00:00:36,542 --> 00:00:40,196
are vast, cool, and
unsympathetic intellects,

16
00:00:40,196 --> 00:00:42,870
looking across space at the planet Earth

17
00:00:42,870 --> 00:00:47,770
with envious eyes, are
they planning an invasion?

18
00:00:47,770 --> 00:00:49,050
- We've been looking at Mars

19
00:00:49,050 --> 00:00:51,600
the way artists and writers imagine it.

20
00:00:51,600 --> 00:00:55,800
A planet of jungles and
deserts inhabited by monsters.

21
00:00:55,800 --> 00:00:57,603
And, of course, beautiful women.

22
00:00:58,450 --> 00:01:00,720
Well, I'm happy to say
that they are wrong.

23
00:01:00,720 --> 00:01:03,240
Mars is far more mysterious than that

24
00:01:03,240 --> 00:01:04,793
and far more surprising.

25
00:01:05,960 --> 00:01:08,400
- [Narrator] Of all the
planets in our solar system

26
00:01:08,400 --> 00:01:11,183
Mars has always held the most fascination.

27
00:01:12,690 --> 00:01:15,163
There is no longer hope
of little green men.

28
00:01:16,240 --> 00:01:18,890
But the question of whether
microbial Martian life

29
00:01:18,890 --> 00:01:22,723
might have once or still
might exist remains.

30
00:01:24,005 --> 00:01:25,790
(dramatic orchestral music)

31
00:01:25,790 --> 00:01:26,760
This is the story

32
00:01:26,760 --> 00:01:29,723
of the first pioneering
missions to reach Mars

33
00:01:31,390 --> 00:01:33,573
and how each encounter
resulted in surprise,

34
00:01:33,573 --> 00:01:34,750
(group cheers)

35
00:01:34,750 --> 00:01:39,022
dismay, or delight for those
who first took us there.

36
00:01:39,022 --> 00:01:40,860
(group cheers and applauds)

37
00:01:40,860 --> 00:01:42,090
- [Man] Each time we got more data,

38
00:01:42,090 --> 00:01:43,720
each time we got closer,

39
00:01:43,720 --> 00:01:45,470
that image was completely obsolete.

40
00:01:46,540 --> 00:01:47,470
That's still going on.

41
00:01:47,470 --> 00:01:48,670
That's an amazing thing.

42
00:01:50,077 --> 00:01:52,507
- [Narrator] The Changing Face of Mars:

43
00:01:52,507 --> 00:01:55,383
Beginnings of the Space Age. Next.

44
00:02:01,000 --> 00:02:04,475
(mysterious orchestral music)

45
00:02:08,894 --> 00:02:11,320
In the cold war between the United States

46
00:02:11,320 --> 00:02:12,971
and the Soviet Union

47
00:02:12,971 --> 00:02:15,200
the space race was a great drama

48
00:02:15,200 --> 00:02:17,667
played out before the entire world.

49
00:02:17,667 --> 00:02:21,230
(rocket ship blasting)

50
00:02:21,230 --> 00:02:22,063
At the beginning

51
00:02:22,063 --> 00:02:25,023
the Soviets with their powerful
rockets were far ahead.

52
00:02:27,520 --> 00:02:28,860
But that began to change

53
00:02:28,860 --> 00:02:31,330
when NASA's Jet Propulsion Laboratory

54
00:02:31,330 --> 00:02:34,910
scored America's first "first" in space

55
00:02:34,910 --> 00:02:39,903
by sending a robotic spacecraft
sailing by Venus in 1962.

56
00:02:40,970 --> 00:02:42,410
- And in those days,

57
00:02:42,410 --> 00:02:44,500
intense cold war rivalry,

58
00:02:44,500 --> 00:02:46,640
you were dealing with things
that had military implications.

59
00:02:46,640 --> 00:02:48,320
And so countries of the world

60
00:02:48,320 --> 00:02:49,630
were trying to say, well,
who's gonna win this?

61
00:02:49,630 --> 00:02:52,110
Who's gonna be the
dominant military power?

62
00:02:52,110 --> 00:02:53,220
And so we had a lot at stake.

63
00:02:53,220 --> 00:02:55,673
It wasn't just trying to get a satellite.

64
00:02:57,410 --> 00:03:01,320
- The name of the game
was beat the Russians.

65
00:03:01,320 --> 00:03:05,203
The space race was very real
and very tangible here at JPL.

66
00:03:06,570 --> 00:03:09,650
We knew that our job
was to get there first

67
00:03:09,650 --> 00:03:11,233
and get there best.

68
00:03:12,710 --> 00:03:15,840
- [Narrator] And now
JPL was aiming for Mars

69
00:03:15,840 --> 00:03:17,393
as were the Soviets.

70
00:03:18,570 --> 00:03:23,060
In June of 1963 Mariner
Project Manager Jack James

71
00:03:23,060 --> 00:03:25,560
announced results of the
latest Russian attempt

72
00:03:25,560 --> 00:03:27,223
to reach the red planet.

73
00:03:29,150 --> 00:03:31,910
- [Jack] Today, the USSR spacecraft Mars 1

74
00:03:31,910 --> 00:03:33,890
made its encounter with Mars,

75
00:03:33,890 --> 00:03:34,840
dead as a doornail.

76
00:03:36,670 --> 00:03:38,560
The Soviets have made
at least seven launches

77
00:03:38,560 --> 00:03:41,193
to Venus and Mars, none
of which have succeeded.

78
00:03:42,370 --> 00:03:43,833
You are better than they are.

79
00:03:46,150 --> 00:03:47,350
You're one of the individuals

80
00:03:47,350 --> 00:03:49,410
who can make Mariner the first spacecraft

81

00:03:49,410 --> 00:03:51,473
to make measurements of the planet Mars.

82
00:03:53,400 --> 00:03:55,793
This depends on each of
you as an individual.

83
00:03:56,970 --> 00:03:57,933
Your initiative

84
00:03:59,350 --> 00:04:00,533
your craftsmanship

85
00:04:01,610 --> 00:04:02,583
your ingenuity

86
00:04:03,570 --> 00:04:04,403
your precision.

87
00:04:05,600 --> 00:04:07,903
It's up to each of us
to make every day count.

88
00:04:09,152 --> 00:04:12,819
(dramatic orchestral music)

89
00:04:15,530 --> 00:04:17,650
- [Narrator] What Jack
James' memo did not say

90
00:04:17,650 --> 00:04:20,020
was how hard it would be to reach Mars.

91
00:04:20,020 --> 00:04:21,120
- [Engineer] Two, one.

92
00:04:22,750 --> 00:04:24,620
- [Narrator] Although JPL's Mariner 2

93
00:04:24,620 --> 00:04:26,950
had been first to reach another planet,

94
00:04:26,950 --> 00:04:28,820
the spacecraft had barely survived

95
00:04:28,820 --> 00:04:31,020
the three and a half
month journey to Venus.

96
00:04:32,070 --> 00:04:34,903
Traveling to Mars would
take almost twice as long.

97
00:04:37,100 --> 00:04:39,900
And nearer to home, five attempts in a row

98
00:04:39,900 --> 00:04:44,767
by JPL spacecraft just to crash
land on the moon had failed.

99
00:04:47,564 --> 00:04:48,428
- The first thing we'll have to do

100
00:04:48,428 --> 00:04:50,870
is organize a team, the best we can get.

101
00:04:50,870 --> 00:04:53,800
We're going to have to come
up with a spacecraft design

102
00:04:53,800 --> 00:04:56,170
that will perform for at least 250 days

103
00:04:56,170 --> 00:04:58,970
outside the orbit of Earth
and out to the orbit of Mars.

104

00:05:00,800 --> 00:05:04,050
- The first challenge
was just getting there.

105
00:05:04,050 --> 00:05:05,270
What you did once you got there

106
00:05:05,270 --> 00:05:07,630
was kind of frosting on the cake.

107
00:05:07,630 --> 00:05:10,700
It was like climbing Mount
Everest and planting a flag.

108
00:05:10,700 --> 00:05:12,640
It's not planting the
flag that's important.

109
00:05:12,640 --> 00:05:14,333
It was just getting there.

110
00:05:16,750 --> 00:05:18,870
- [Narrator] The United
States took great pride

111
00:05:18,870 --> 00:05:21,060
in having been first to Venus.

112
00:05:21,060 --> 00:05:23,240
It was an accomplishment widely acclaimed

113
00:05:23,240 --> 00:05:25,493
from the Rose Parade to the White House.

114
00:05:26,500 --> 00:05:28,570
But the achievement did not automatically

115
00:05:28,570 --> 00:05:32,023
give JPL a green light

to proceed on to Mars.

116
00:05:33,890 --> 00:05:35,880
The lab had to compete against a proposal

117
00:05:35,880 --> 00:05:38,953
by NASA's Goddard Space
Flight Center in Maryland.

118
00:05:40,080 --> 00:05:43,023
Goddard wanted to land
on the Martian surface.

119
00:05:44,700 --> 00:05:46,740
JPL's more cautious proposal

120
00:05:46,740 --> 00:05:49,053
was to replicate their success at Venus,

121
00:05:49,980 --> 00:05:54,410
launching two identical
spacecraft to fly by Mars

122
00:05:54,410 --> 00:05:57,193
with hopes that at least
one would make it there.

123
00:06:00,130 --> 00:06:02,160
Ultimately, the choice was made for NASA

124
00:06:02,160 --> 00:06:03,880
when it became clear that the rocket

125
00:06:03,880 --> 00:06:06,963
the Goddard Proposal required
would not be available.

126
00:06:09,730 --> 00:06:14,730
Still, JPL's more conservative

approach did not mean easy.

127
00:06:15,270 --> 00:06:18,393
Just reaching Mars was
an enormous challenge.

128
00:06:19,270 --> 00:06:21,030
And JPL's mission to Venus

129
00:06:21,030 --> 00:06:22,920
had been with just a souped-up version

130
00:06:22,920 --> 00:06:25,703
of a spacecraft built
only to reach the Moon.

131
00:06:26,629 --> 00:06:30,129
(upbeat orchestral music)

132
00:06:31,110 --> 00:06:35,243
Going to Mars required a real
deep space flying machine.

133
00:06:38,600 --> 00:06:40,853
- Mariner 4 was really
the first spacecraft

134
00:06:40,853 --> 00:06:45,170
that were specifically designed
for planetary exploration.

135
00:06:45,170 --> 00:06:47,110
Mariner 4 had all of the things

136
00:06:47,110 --> 00:06:51,480
that became characteristic
of JPL missions after that.

137
00:06:51,480 --> 00:06:54,970

An integrated packaging
and structural design

138
00:06:54,970 --> 00:06:56,600
an octagonal bus

139
00:06:56,600 --> 00:06:58,460
extensive use of louvers

140
00:06:58,460 --> 00:07:00,260
for temperature control

141
00:07:00,260 --> 00:07:02,080
three axis stabilized

142
00:07:02,080 --> 00:07:06,211
loaded with instruments that
could articulate and point.

143
00:07:06,211 --> 00:07:08,600
(electric whirring)

144
00:07:08,600 --> 00:07:10,120
- [Narrator] Traveling away from the Sun

145
00:07:10,120 --> 00:07:13,120
meant encountering a colder,
more hostile environment

146
00:07:13,120 --> 00:07:15,193
with less ability to draw power.

147
00:07:17,800 --> 00:07:20,230
The solar panels had to be
more than twice the size

148
00:07:20,230 --> 00:07:21,733
of those flown to Venus.

149
00:07:25,450 --> 00:07:27,720
(electric whirring)

150
00:07:27,720 --> 00:07:28,630
For the first time

151
00:07:28,630 --> 00:07:29,960
the Earth could not be used

152
00:07:29,960 --> 00:07:33,040
for establishing the
spacecraft's orientation,

153
00:07:33,040 --> 00:07:34,993
known as attitude control.

154
00:07:37,350 --> 00:07:39,650
Instead, these spacecraft
would have to fly

155
00:07:39,650 --> 00:07:41,293
by sighting a star.

156
00:07:42,470 --> 00:07:43,960
- The spacecraft will roll

157
00:07:43,960 --> 00:07:47,915
permitting the star sensor
to search for Canopus.

158
00:07:47,915 --> 00:07:51,280
Once sighted, the gas jets
will keep it locked on.

159
00:07:51,280 --> 00:07:53,660
It may be a very difficult operation

160
00:07:53,660 --> 00:07:56,160

which will have to be
backed up by ground command.

161
00:07:58,041 --> 00:08:01,010
- [Narrator] Because
distances were far greater

162
00:08:01,010 --> 00:08:03,300
communications links
arrayed around the world

163
00:08:03,300 --> 00:08:04,553
had to be strengthened.

164
00:08:06,230 --> 00:08:09,633
What came to be known as
The Deep Space Network.

165
00:08:10,980 --> 00:08:12,280
- Stations are so located

166
00:08:12,280 --> 00:08:14,375
that the spacecraft in deep space

167
00:08:14,375 --> 00:08:17,610
will be in direct line of sight contact,

168
00:08:17,610 --> 00:08:20,920
at least one of the
stations, continuously.

169
00:08:20,920 --> 00:08:21,944
- [Narrator] Above all

170
00:08:21,944 --> 00:08:24,419
there was a very basic
engineering concern.

171
00:08:24,419 --> 00:08:28,420

How long could a spacecraft
withstand the harsh environment

172
00:08:28,420 --> 00:08:29,293
of space?

173
00:08:30,140 --> 00:08:32,130
- For one thing, instead
of a three-day mission

174
00:08:32,130 --> 00:08:33,564
we were talking about a mission

175
00:08:33,564 --> 00:08:35,203
that's gonna be eight or nine months.

176
00:08:36,408 --> 00:08:39,325
(orchestral music)

177
00:08:42,150 --> 00:08:43,800
We'd run through the liability analysis

178
00:08:43,800 --> 00:08:48,313
and that number came out to
be 30% probability of success.

179
00:08:50,730 --> 00:08:52,580
We tended not to believe the numbers.

180
00:08:53,465 --> 00:08:54,520
We sort of convinced ourselves

181
00:08:54,520 --> 00:08:57,620
that God did not really ordain
that resistors should fail

182
00:08:57,620 --> 00:09:01,910
at .0 whatever it was
percent per 1000 hours.

183
00:09:01,910 --> 00:09:03,223
And we just plowed on.

184
00:09:07,210 --> 00:09:09,150
- [Narrator] The twin Mariners 3 and 4,

185
00:09:09,150 --> 00:09:11,350
which some dubbed flying windmills,

186
00:09:11,350 --> 00:09:13,363
were remarkable feats of engineering,

187
00:09:15,700 --> 00:09:19,713
but flying to Mars was
only half the challenge.

188
00:09:26,248 --> 00:09:28,665
(soft music)

189
00:09:35,050 --> 00:09:38,483
Just reaching Mars would be
an accomplishment in itself.

190
00:09:39,350 --> 00:09:42,113
But the larger goal was
learning what was there.

191
00:09:43,570 --> 00:09:46,620
For scientists capturing
even a glimpse of Mars

192
00:09:46,620 --> 00:09:48,170
as a spacecraft flew past

193
00:09:48,170 --> 00:09:50,523
might answer whether life existed there.

194

00:09:53,710 --> 00:09:55,800
It was a question very much on the mind

195
00:09:55,800 --> 00:09:58,223
of Caltech geologist Bruce Murray.

196
00:10:00,220 --> 00:10:02,720
- You couldn't go to
Mars without a camera.

197
00:10:02,720 --> 00:10:07,720
So a major development was
finding some technology

198
00:10:07,820 --> 00:10:09,320
that could be used for a camera.

199
00:10:10,559 --> 00:10:13,650
Then NASA chose a well known
physics professor at Caltech

200
00:10:13,650 --> 00:10:16,900
by the name of Robert
Lee, a wonderful man,

201
00:10:16,900 --> 00:10:17,930
to set up the team

202
00:10:17,930 --> 00:10:22,390
and together design this
first space camera system.

203
00:10:22,390 --> 00:10:25,273
In fact, it was the first
digital camera of any kind.

204
00:10:26,895 --> 00:10:30,030
- After many meetings and
a lot of give and take

205
00:10:30,030 --> 00:10:32,620
we finally agreed that we
should try to get a series

206
00:10:32,620 --> 00:10:34,140
of black and white photographs

207
00:10:35,070 --> 00:10:36,880
that should begin at the limb

208
00:10:36,880 --> 00:10:40,223
and continue across the
planet to the shadowed area.

209
00:10:41,550 --> 00:10:45,160
The photographs should show
detail at least 10 times better

210
00:10:45,160 --> 00:10:46,533
than any taken from Earth.

211
00:10:47,720 --> 00:10:50,710
Considering the altitude,
angle of approach,

212
00:10:50,710 --> 00:10:54,453
possible resolution and radio
sending back data to Earth

213
00:10:54,453 --> 00:10:57,803
we designed the system
to take 22 photographs.

214
00:10:59,630 --> 00:11:00,730
- [Engineer] Lift off.

215
00:11:01,703 --> 00:11:02,536
Lift off.

216
00:11:02,536 --> 00:11:04,420
- [Narrator] On November 5, 1964

217
00:11:04,420 --> 00:11:08,050
Mariner 3 with the world's
first digital camera aboard

218
00:11:08,050 --> 00:11:10,493
lifted off from Cape Canaveral, Florida.

219
00:11:12,820 --> 00:11:14,940
- The launch is always exciting.

220
00:11:14,940 --> 00:11:16,540
It was even more exciting in those days

221
00:11:16,540 --> 00:11:18,540
because about half of them were failing.

222
00:11:20,330 --> 00:11:22,963
- [Narrator] And that
was Mariner 3's fate.

223
00:11:23,910 --> 00:11:25,040
Within an hour of launch

224
00:11:25,040 --> 00:11:27,790
telemetry showed that the
mission was in serious trouble.

225
00:11:30,230 --> 00:11:31,640
For some unknown reason

226
00:11:31,640 --> 00:11:34,883
the spacecraft's solar panels
were not drawing power.

227
00:11:36,530 --> 00:11:38,730

- It had enough energy to escape the Earth

228
00:11:38,730 --> 00:11:41,120
but not anywhere near
enough to get to Mars.

229
00:11:41,120 --> 00:11:44,060
So it only lasted as long
as the batteries could last.

230
00:11:44,060 --> 00:11:45,423
It lasted a few hours.

231
00:11:46,480 --> 00:11:49,610
It was kind of devastating news.

232
00:11:49,610 --> 00:11:51,120
But we were, to be honest,

233
00:11:51,120 --> 00:11:53,917
we were getting kind of
used to that in those days.

234
00:11:53,917 --> 00:11:57,030
(printer whirring)

235
00:11:57,030 --> 00:11:59,610
- [Narrator] The launch of
Mariner 4 was now delayed

236
00:11:59,610 --> 00:12:02,400
while engineers worked against
the alignment of the planets

237
00:12:02,400 --> 00:12:04,463
to understand what had gone wrong.

238
00:12:05,630 --> 00:12:09,660
- There were three weeks until

Mariner 4 had to be launched

239
00:12:09,660 --> 00:12:13,340
because of this geometry
between the Earth and Mars

240
00:12:13,340 --> 00:12:16,713
meant that you had to
catch this window in time.

241
00:12:18,880 --> 00:12:22,940
So in that three weeks JPL
and the contractor figured out

242
00:12:22,940 --> 00:12:25,470
what had caused that failure.

243
00:12:25,470 --> 00:12:26,900
- [Narrator] The problem was tracked down

244
00:12:26,900 --> 00:12:28,223
to the nose fairing.

245
00:12:29,770 --> 00:12:32,883
Its purpose was to protect
the spacecraft during launch.

246
00:12:34,820 --> 00:12:37,450
The contractor, attempting
to reduce weight,

247
00:12:37,450 --> 00:12:39,160
had built it out of a light material

248
00:12:39,160 --> 00:12:40,853
that collapsed during ascent.

249
00:12:43,910 --> 00:12:47,170
Working around the clock

before the launch window closed

250
00:12:47,170 --> 00:12:49,083
engineers modified the fairing.

251
00:12:50,337 --> 00:12:52,300
- [Engineer] Prepare for launch.

252
00:12:52,300 --> 00:12:54,430
[Indistinct] Engine start.

253
00:12:54,430 --> 00:12:56,540
- [Narrator] Remarkably just
two weeks and three days

254
00:12:56,540 --> 00:12:58,870
after the failure of Mariner 3

255
00:12:58,870 --> 00:13:01,821
its twin was on its way to Mars.

256
00:13:01,821 --> 00:13:03,130
(rocket engine rumbling)

257
00:13:03,130 --> 00:13:04,347
- [Engineer] Roger 137.

258
00:13:05,330 --> 00:13:07,180
- [Engineer] We're on our way, roger.

259
00:13:09,440 --> 00:13:10,952
- [Narrator] Ahead was
seven and a half months

260
00:13:10,952 --> 00:13:15,952
and 325 million
unforgiving miles of travel

261

00:13:16,040 --> 00:13:17,463
through deep space.

262
00:13:24,760 --> 00:13:25,740
During the cruise

263
00:13:25,740 --> 00:13:28,340
Jack James turned over the
operation of the mission

264
00:13:28,340 --> 00:13:29,733
to Dan Schneiderman.

265
00:13:31,870 --> 00:13:34,070
He had been the Spacecraft System Manager

266
00:13:34,070 --> 00:13:35,473
for the mission to Venus.

267
00:13:38,000 --> 00:13:39,940
Schneiderman grew up on a chicken farm

268
00:13:39,940 --> 00:13:41,613
in Bakersfield, California.

269
00:13:42,480 --> 00:13:44,900
In World War Two he had worked in radar

270
00:13:44,900 --> 00:13:47,150
in the Aleutian islands.

271
00:13:47,150 --> 00:13:49,220
Following the war he used the GI bill

272
00:13:49,220 --> 00:13:51,330
to get a degree in engineering.

273
00:13:51,330 --> 00:13:54,890

Then he got a job
designing electric guitars.

274
00:13:54,890 --> 00:13:57,660
Unimpressed with the
music most of them made

275
00:13:57,660 --> 00:14:00,833
he quit and found his way to JPL.

276
00:14:02,120 --> 00:14:03,950
- He was a real character.

277
00:14:03,950 --> 00:14:07,710
And later in years I would
say in a group of people

278
00:14:07,710 --> 00:14:09,250
I owed Dan... everything I ever learned

279
00:14:09,250 --> 00:14:10,347
I owed to Dan or something like that.

280
00:14:10,347 --> 00:14:11,720
And he would get mortified.

281
00:14:11,720 --> 00:14:13,720
He was "Oh, Casani,
please don't say that!"

282
00:14:15,080 --> 00:14:17,490
He would wax philosophical.

283
00:14:17,490 --> 00:14:19,672
He liked to draw analogies.

284
00:14:19,672 --> 00:14:23,260
I can remember him
talking about resolution--

285
00:14:23,260 --> 00:14:25,180
what you can see with the camera.

286
00:14:25,180 --> 00:14:27,560
- It's interesting to look at things

287
00:14:29,250 --> 00:14:31,000
and look at them as you get closer.

288
00:14:32,180 --> 00:14:37,080
For example, if you go
far away from, let's say,

289
00:14:37,080 --> 00:14:39,513
if you were an angel or
some thing like that there,

290
00:14:39,513 --> 00:14:42,260
then you flew high above
Southern California,

291
00:14:42,260 --> 00:14:44,680
you look down, you might see a greenery

292
00:14:46,680 --> 00:14:49,620
and then you lower your
altitude a little bit.

293
00:14:49,620 --> 00:14:52,250
And this greenery becomes patchy greenery.

294
00:14:52,250 --> 00:14:53,610
What looked to be homogeneous

295
00:14:53,610 --> 00:14:55,930
all of a sudden becomes random.

296

00:14:55,930 --> 00:14:56,960
Okay?

297
00:14:56,960 --> 00:14:58,053
You come lower

298
00:14:59,260 --> 00:15:02,090
and all of a sudden what you're
seeing is a single forest.

299
00:15:02,090 --> 00:15:04,294
So what was random

300
00:15:04,294 --> 00:15:05,683
becomes homogeneous again.

301
00:15:06,760 --> 00:15:08,070
- He was a worrywart

302
00:15:08,070 --> 00:15:09,900
didn't sleep well.

303
00:15:09,900 --> 00:15:13,240
And he would say that
a project is like a log

304
00:15:13,240 --> 00:15:15,130
floating down a river.

305
00:15:15,130 --> 00:15:17,490
All the people working
on the project are ants

306
00:15:17,490 --> 00:15:18,690
crawling around this log.

307
00:15:18,690 --> 00:15:21,900
And the project manager is an
ant at the front of the log

308
00:15:21,900 --> 00:15:25,330
telling all the other ants to pull right

309
00:15:25,330 --> 00:15:28,920
to avoid those rapids up
ahead or to pull left.

310
00:15:28,920 --> 00:15:31,230
And of course, whatever the ants do,

311
00:15:31,230 --> 00:15:33,240
doesn't make a damn bit of difference.

312
00:15:33,240 --> 00:15:34,073
The log is gonna go
where the river takes it.

313
00:15:36,121 --> 00:15:38,880
I think it was expressing
a sense of helplessness,

314
00:15:38,880 --> 00:15:41,560
that there's not much that anybody can do

315
00:15:41,560 --> 00:15:42,810
to influence the outcome.

316
00:15:49,870 --> 00:15:51,790
- [Narrator] Mariner 4's journey to Mars

317
00:15:51,790 --> 00:15:53,503
was relatively uneventful.

318
00:15:55,829 --> 00:15:57,690
The spacecraft at times had difficulty

319
00:15:57,690 --> 00:15:59,493

locating the star Canopus.

320
00:16:01,200 --> 00:16:04,703
That caused nervous moments
when contact was sometimes lost.

321
00:16:06,066 --> 00:16:08,733
(ominous music)

322
00:16:10,040 --> 00:16:12,300
But only one trajectory
maneuver was needed

323
00:16:12,300 --> 00:16:14,730
to keep the spacecraft on course,

324
00:16:14,730 --> 00:16:16,510
more or less.

325
00:16:16,510 --> 00:16:18,160
- In the beginning, when I first started,

326
00:16:18,160 --> 00:16:19,370
I was the trajectory engineer.

327
00:16:19,370 --> 00:16:21,870
So it was my job to design the flight path

328
00:16:21,870 --> 00:16:24,240
that would take the
spacecraft from here to Mars.

329
00:16:24,240 --> 00:16:26,980
- The Mariner 4 trajectory
as it leaves the Earth

330
00:16:26,980 --> 00:16:27,900
and goes to Mars

331
00:16:27,900 --> 00:16:30,700
will be approximately an
elliptical orbit about the sun,

332
00:16:31,571 --> 00:16:32,404
the-

333
00:16:32,404 --> 00:16:34,000
- We had not been to Mars
with a spacecraft before.

334
00:16:34,000 --> 00:16:36,600
And as we were approaching the planet,

335
00:16:36,600 --> 00:16:37,730
the last couple of hours,

336
00:16:37,730 --> 00:16:40,320
we realized that our
estimates of the orbit

337
00:16:40,320 --> 00:16:42,270
were beginning to change significantly.

338
00:16:43,220 --> 00:16:47,170
In fact, we ended up missing
by about 5 or 6,000 miles

339
00:16:47,170 --> 00:16:48,750
from where we'd aimed,

340
00:16:48,750 --> 00:16:51,340
which by today's standards is abysmal.

341
00:16:51,340 --> 00:16:53,913
But by those standards
was actually not bad.

342

00:16:55,106 --> 00:16:58,880
The last hour to half
hour before occultation

343
00:16:58,880 --> 00:17:01,010
was a wild scramble of
trying to run orbits,

344
00:17:01,010 --> 00:17:02,220
trying to get the last data,

345
00:17:02,220 --> 00:17:04,870
trying to get on the
phone and call Goldstone

346
00:17:04,870 --> 00:17:07,510
and tell them what time to
turn on the tape recorders.

347
00:17:07,510 --> 00:17:08,893
It was a wild scramble.

348
00:17:11,353 --> 00:17:14,250
- [Engineer] This is Mariner
control center at JPL.

349
00:17:14,250 --> 00:17:16,320
Mariner 4 is currently being tracked

350
00:17:16,320 --> 00:17:19,640
by station 51, Johannesburg.

351
00:17:19,640 --> 00:17:24,640
The spacecraft is 134.217
million miles from Earth.

352
00:17:25,290 --> 00:17:28,383
And 50,142 miles from Mars.

353

00:17:30,770 --> 00:17:33,100
- [Narrator] As the spacecraft neared Mars

354
00:17:33,100 --> 00:17:35,780
everyone knew this would
be an historic moment

355
00:17:37,100 --> 00:17:38,673
and a white knuckled one.

356
00:17:39,680 --> 00:17:42,950
A flyby of Mars meant a single pass

357
00:17:42,950 --> 00:17:45,003
and no second chances.

358
00:17:47,500 --> 00:17:50,470
Schneiderman and his first
lieutenant Bill Collier

359
00:17:50,470 --> 00:17:53,003
we're working a long list of what ifs.

360
00:17:54,480 --> 00:17:57,580
A major concern was the star tracker.

361
00:17:57,580 --> 00:18:00,240
If Mariner 4 lost sight of Canopus

362
00:18:00,240 --> 00:18:02,930
the spacecraft might end
up facing away from Mars

363
00:18:02,930 --> 00:18:04,510
during the flyby.

364
00:18:04,510 --> 00:18:06,760
And that would mean
having successfully flown

365
00:18:06,760 --> 00:18:09,140
for eight months through deep space

366
00:18:09,140 --> 00:18:11,690
only to fail at the critical hour.

367
00:18:11,690 --> 00:18:15,753
- It's this discussion
of losing Canopus lock...

368
00:18:18,333 --> 00:18:21,437
- Boy, that just really scares you...

369
00:18:22,954 --> 00:18:25,167
It just scares you to death.

370
00:18:25,167 --> 00:18:26,000
- Because...

371
00:18:26,000 --> 00:18:27,833
- If that hits us, we
are really in trouble.

372
00:18:27,833 --> 00:18:30,010
- Well, we're going to have a frantic day

373
00:18:30,010 --> 00:18:32,053
no matter what time that might occur.

374
00:18:34,430 --> 00:18:36,700
- [Narrator] While Schneiderman
and Collier fretted

375
00:18:36,700 --> 00:18:38,590
the science imaging team joked

376
00:18:38,590 --> 00:18:41,254

about what they might soon be seeing.

377
00:18:41,254 --> 00:18:46,254
- What are we going to
do when we see H-E-L-P

378
00:18:47,010 --> 00:18:48,323
stamped out in the snow?

379
00:18:49,670 --> 00:18:50,640
- What John Casani said

380
00:18:50,640 --> 00:18:53,190
we're going to see is a bunch of black.

381
00:18:53,190 --> 00:18:55,333
(laughing)

382
00:18:55,333 --> 00:18:56,983
These guys are gonna be firing
at us as soon as we go by.

383
00:18:58,070 --> 00:18:58,903
- [Narrator] Meanwhile

384
00:18:58,903 --> 00:19:01,683
the engineers considered more what-ifs.

385
00:19:03,700 --> 00:19:06,980
One was the spacecraft's
primitive computer.

386
00:19:06,980 --> 00:19:09,790
It would be in control during the flyby.

387
00:19:09,790 --> 00:19:11,250
But if something went wrong

388

00:19:11,250 --> 00:19:13,183
the computer had no backup plan.

389
00:19:14,540 --> 00:19:17,250
Should engineers leave well enough alone

390
00:19:17,250 --> 00:19:19,423
or send up a new set of commands?

391
00:19:20,410 --> 00:19:22,550
That carried its own risk.

392
00:19:22,550 --> 00:19:26,073
New instructions might only
confuse the spacecraft.

393
00:19:26,980 --> 00:19:27,890
- These are the questions.

394
00:19:27,890 --> 00:19:30,810
This is the soul searching
you go through to...

395
00:19:30,810 --> 00:19:32,360
Boy, don't don't worry.

396
00:19:32,360 --> 00:19:34,510
Our first reaction was,

397
00:19:34,510 --> 00:19:37,530
man, we'll let that
space perform for itself.

398
00:19:37,530 --> 00:19:39,410
Let's not horse around with it.

399
00:19:39,410 --> 00:19:42,040
But as soon as you start
really asking these questions

400
00:19:42,040 --> 00:19:47,040
of yourself, then you begin to
think we can't take a chance.

401
00:19:47,050 --> 00:19:49,010
We've got to put ourselves in a position

402
00:19:49,010 --> 00:19:52,670
where we've done everything
we can humanly do

403
00:19:52,670 --> 00:19:57,423
to ensure or at least to
enhance the chances of success.

404
00:19:58,820 --> 00:20:01,220
- [Narrator] The main fear
was that the tape recorder

405
00:20:01,220 --> 00:20:03,520
might not turn off.

406
00:20:03,520 --> 00:20:04,750
If that happened

407
00:20:04,750 --> 00:20:08,120
the images would be recorded
over following the flyby

408
00:20:08,120 --> 00:20:10,390
with the blackness of space.

409
00:20:10,390 --> 00:20:13,653
If a tape recorder fails to turn off

410
00:20:16,250 --> 00:20:17,643
we cannot tell that.

411
00:20:18,750 --> 00:20:22,763
That's the rationale behind
the transmission of DC 26.

412
00:20:24,798 --> 00:20:26,863
Is to protect the pictures.

413
00:20:29,036 --> 00:20:29,869
(ominous music)

414
00:20:29,869 --> 00:20:32,380
- [Narrator] On July 14, 1965

415
00:20:32,380 --> 00:20:36,780
another command called
DC 25 was transmitted.

416
00:20:36,780 --> 00:20:38,770
With it, Mariner 4 began taking

417
00:20:38,770 --> 00:20:41,343
the first ever closeup pictures of Mars.

418
00:20:43,431 --> 00:20:46,302
- The DC 25 command should initiate

419
00:20:46,302 --> 00:20:48,863
a platform scanning action.

420
00:20:48,863 --> 00:20:49,696
(beeping sounds)

421
00:20:49,696 --> 00:20:51,510
If the command is not received

422
00:20:51,510 --> 00:20:54,230
the spacecraft will
initiate the scanning itself

423
00:20:54,230 --> 00:20:55,253
in about one hour.

424
00:20:56,270 --> 00:20:59,343
We expect that 21
pictures will be recorded.

425
00:21:00,400 --> 00:21:02,512
After other planetary data

426
00:21:02,512 --> 00:21:04,400
are returned to Earth

427
00:21:04,400 --> 00:21:07,170
the space craft will
automatically initiate playback

428
00:21:07,170 --> 00:21:08,283
of a TV picture.

429
00:21:09,730 --> 00:21:11,320
The first picture will cover an area

430
00:21:11,320 --> 00:21:14,873
of approximately 176
miles square on the sunlit

431
00:21:14,873 --> 00:21:16,230
limb on the planet.

432
00:21:16,230 --> 00:21:17,240
- I wish I was as sure as he is.

433
00:21:17,240 --> 00:21:19,220
- In about a couple of minutes now

434
00:21:19,220 --> 00:21:22,460

we should be able to determine
that TV camera shutter

435
00:21:22,460 --> 00:21:25,790
is operating and that
the recorder is running.

436
00:21:25,790 --> 00:21:27,980
Although we will not be
able to determine definitely

437
00:21:27,980 --> 00:21:31,050
whether pictures are actually
being recorded on the tape

438
00:21:31,050 --> 00:21:32,553
until they are played back.

439
00:21:33,419 --> 00:21:36,336
(printer whirring)

440
00:21:38,037 --> 00:21:39,730
- Hey, we got wires dangling.

441
00:21:39,730 --> 00:21:41,013
It's time for 26 to go.

442
00:21:41,910 --> 00:21:45,000
- [Narrator] "26" Was DC 26,

443
00:21:45,000 --> 00:21:48,210
the command for the recorder
to stop taking pictures.

444
00:21:48,210 --> 00:21:49,810
- [Engineer] Pictures 281 drive.

445
00:21:53,138 --> 00:21:54,960
- Here it is. (laughing)

446
00:21:54,960 --> 00:21:56,440
- The system had worked.

447
00:21:57,730 --> 00:22:00,363
The picture was recorded
onboard the spacecraft.

448
00:22:02,460 --> 00:22:03,460
That was a big deal.

449
00:22:05,530 --> 00:22:08,210
- Gee, it's not safe to
say that's the only thing

450
00:22:08,210 --> 00:22:10,550
because we're really subject to...

451
00:22:13,740 --> 00:22:16,033
Almost anything could occur.

452
00:22:17,521 --> 00:22:20,335
(indistinct chatter)

453
00:22:20,335 --> 00:22:23,094
I just hope nothing unusual occurs.

454
00:22:23,094 --> 00:22:24,494
I hope it keeps right along.

455
00:22:25,681 --> 00:22:27,581
Being just as easy as it's been so far.

456
00:22:29,280 --> 00:22:30,113
- [Narrator] Later

457
00:22:30,113 --> 00:22:33,220
Mariner 4 transmitted back

a conflicting message.

458
00:22:33,220 --> 00:22:37,170
The tape recorder might not
have worked as expected.

459
00:22:37,170 --> 00:22:42,052
- There were some extra events
that came back via telemetry.

460
00:22:42,052 --> 00:22:46,110
And if you read those
events in a certain way

461
00:22:46,110 --> 00:22:49,190
it said the tape recorder
had stopped recording.

462
00:22:49,190 --> 00:22:52,673
And that caused great panic
among the management here.

463
00:22:54,180 --> 00:22:55,670
- Yeah, what about the tape recorder?

464
00:22:55,670 --> 00:22:58,710
- Well, the tape recorder, there's a...

465
00:22:58,710 --> 00:22:59,673
The answers that I got late here

466
00:22:59,673 --> 00:23:02,070
is that we got a normal first end of tape

467
00:23:02,070 --> 00:23:03,944
and a normal second end of tape.

468
00:23:03,944 --> 00:23:05,600
And it appeared as though

that the second end of tape

469
00:23:05,600 --> 00:23:07,540
switched the data and coded a mode two

470
00:23:07,540 --> 00:23:09,310
just as it is supposed to.

471
00:23:09,310 --> 00:23:12,180
But the answer here,
the last I heard there,

472
00:23:12,180 --> 00:23:13,870
was that there was some funny business

473
00:23:13,870 --> 00:23:15,570
in the first 10 picture recording.

474
00:23:16,600 --> 00:23:19,210
- The TV system which should've
turned the tape recorder

475
00:23:19,210 --> 00:23:20,073
on and off

476
00:23:22,030 --> 00:23:24,250
may have failed to turn it off

477
00:23:24,250 --> 00:23:26,460
and the tape runs through it faster.

478
00:23:26,460 --> 00:23:29,540
And that was exactly the
reason we sent this command 26

479
00:23:30,384 --> 00:23:33,403
was to save as many pictures
as we could on the tape.

480
00:23:37,490 --> 00:23:39,223
We don't know for sure it's happening.

481
00:23:42,580 --> 00:23:45,823
- [Narrator] Mariner 4 carried
other science instruments.

482
00:23:47,550 --> 00:23:49,340
And those measurements were programmed

483
00:23:49,340 --> 00:23:51,203
to be transmitted back first.

484
00:23:52,200 --> 00:23:56,660
Only later would the pictures
come, if there were any.

485
00:23:56,660 --> 00:24:00,490
- The data came back extremely
slowly from deep space.

486
00:24:00,490 --> 00:24:02,420
Went into the Goldstone tracking antenna

487
00:24:02,420 --> 00:24:04,290
out in the middle of the Mojave desert

488
00:24:04,290 --> 00:24:06,280
and came to JPL by teletype.

489
00:24:06,280 --> 00:24:07,130
It was that slow.

490
00:24:08,759 --> 00:24:10,129
Chic chic chic chic.

491
00:24:10,129 --> 00:24:11,560
- Chanka chanka chanka chanka

492
00:24:11,560 --> 00:24:14,490
- The data playback rate was
only 8 1/3 bits per second,

493
00:24:14,490 --> 00:24:17,490
which is, as Jack James
the Project Manager

494
00:24:17,490 --> 00:24:20,220
at one time said it was a slow morse code.

495
00:24:20,220 --> 00:24:22,050
And so it would take hours

496
00:24:22,050 --> 00:24:23,650
to get each individual picture back.

497
00:24:23,650 --> 00:24:27,023
So it was gonna be days before
you got all the data back.

498
00:24:28,180 --> 00:24:30,280
- [Narrator] Eight days in fact.

499
00:24:30,280 --> 00:24:33,460
This did not sit well when
announced to the restless press

500
00:24:33,460 --> 00:24:34,963
assembled at JPL.

501
00:24:36,128 --> 00:24:38,031
- The performance of the spacecraft

502
00:24:38,031 --> 00:24:41,070
during the picture taking sequence

503

00:24:41,070 --> 00:24:44,013
was not precisely accurate.

504
00:24:45,230 --> 00:24:49,695
There were some anomalies.
And we have attempted

505
00:24:49,695 --> 00:24:52,833
in this short period of time
to diagnose these anomalies.

506
00:24:53,680 --> 00:24:55,090
We are still optimistic

507
00:24:56,310 --> 00:24:58,210
that we did indeed take some pictures.

508
00:24:59,930 --> 00:25:03,220
We have always said
that we cannot determine

509
00:25:03,220 --> 00:25:04,900
whether or not these
pictures have been taken

510
00:25:04,900 --> 00:25:07,380
even if the system performed correctly

511
00:25:07,380 --> 00:25:11,494
until tomorrow morning when
the pictures playback sequence

512
00:25:11,494 --> 00:25:12,994
will be initiated.

513
00:25:14,120 --> 00:25:17,080
- This was a time when life on Mars

514
00:25:17,080 --> 00:25:19,660

and Mars was a very exciting thing.

515
00:25:19,660 --> 00:25:21,840
There were only three major
networks in those good old days.

516
00:25:21,840 --> 00:25:24,830
They were all sitting
in Von Karman auditorium

517
00:25:24,830 --> 00:25:25,790
getting very restless.

518
00:25:25,790 --> 00:25:27,170
They came to get their story

519
00:25:27,170 --> 00:25:29,120
and they kept saying with the pictures,

520
00:25:29,120 --> 00:25:30,250
well, they're working on them.

521
00:25:30,250 --> 00:25:32,640
And so they began to get pretty nasty,

522
00:25:32,640 --> 00:25:34,860
demanding that this is a public's money.

523
00:25:34,860 --> 00:25:36,420
This is a public thing, which is true.

524
00:25:36,420 --> 00:25:37,450
Why can't we see them?

525
00:25:37,450 --> 00:25:39,763
Well, the answer was
there wasn't much to see.

526

00:25:42,030 --> 00:25:43,200
- Difficulty in this businesses

527
00:25:43,200 --> 00:25:47,163
is that it's such a difficult game

528
00:25:47,163 --> 00:25:49,404
where your experience
tells you that almost

529
00:25:49,404 --> 00:25:54,404
anything abnormal usually spells disaster.

530
00:25:56,770 --> 00:25:58,770
- [Narrator] After what seemed an eternity

531
00:25:58,770 --> 00:26:02,050
Mariner 4 began transmitting back images.

532
00:26:02,050 --> 00:26:04,200
Assuming that was what was actually stored

533
00:26:04,200 --> 00:26:05,323
on the tape recorder.

534
00:26:06,200 --> 00:26:07,460
The pictures were to come back

535
00:26:07,460 --> 00:26:10,010
in the form of ones and zeros,

536
00:26:10,010 --> 00:26:12,263
each number representing a shade of gray.

537
00:26:14,370 --> 00:26:17,710
The first numbers transmitted
corresponded to black,

538

00:26:17,710 --> 00:26:18,833
as was expected.

539
00:26:22,010 --> 00:26:23,210
- They may be all black

540
00:26:26,456 --> 00:26:28,407
but we got something there.

541
00:26:35,500 --> 00:26:36,570
Hey, here we go.

542
00:26:36,570 --> 00:26:38,340
- There she goes.

543
00:26:38,340 --> 00:26:39,173
That's data.

544
00:26:44,833 --> 00:26:47,170
- This is kind of preliminary
analysis of this data.

545
00:26:47,170 --> 00:26:48,003
Can you describe what you see on Mars?

546
00:26:48,003 --> 00:26:49,093
- Yes, it's there.

547
00:26:51,214 --> 00:26:54,297
(indistinct chatter)

548
00:26:56,020 --> 00:27:00,043
Congratulations to the both
of you as a matter of fact.

549
00:27:04,209 --> 00:27:05,042
- Oh, boy.

550

00:27:10,337 --> 00:27:11,913
- Give me Bruce Murray's phone number.

551
00:27:13,615 --> 00:27:16,977
Well, they were the Mars
picture interpreters.

552
00:27:20,230 --> 00:27:21,063
Yeah.

553
00:27:21,063 --> 00:27:24,437
The data is coming in, boy,
what are you doing in bed?

554
00:27:24,437 --> 00:27:26,650
(indistinct background chatter)

555
00:27:26,650 --> 00:27:28,300
You didn't know?

556
00:27:28,300 --> 00:27:30,963
Wow, the numbers are
coming in hot off the line.

557
00:27:33,540 --> 00:27:34,980
Well, yeah. Okay.

558
00:27:34,980 --> 00:27:35,823
Shade at least.

559
00:27:40,370 --> 00:27:43,050
- [Narrator] The processing
of images was far too slow

560
00:27:43,050 --> 00:27:43,883
for some.

561
00:27:45,930 --> 00:27:49,440
Desperate to see Mars,

engineers took matters,

562
00:27:49,440 --> 00:27:53,510
or in this case, numbers
into their own hands.

563
00:27:53,510 --> 00:27:55,780
- Two or three of us who had
worked on the tape recorder

564
00:27:55,780 --> 00:27:56,950
came up with these schemes

565
00:27:56,950 --> 00:27:59,740
of how to try to sketch
out the data in real time

566
00:27:59,740 --> 00:28:00,673
as it came in.

567
00:28:02,191 --> 00:28:04,360
And it was kind of a contest.

568
00:28:04,360 --> 00:28:07,390
And the one that won was
essentially adding machine

569
00:28:07,390 --> 00:28:09,520
paper tapes tacked to a wall.

570
00:28:09,520 --> 00:28:11,020
And that's the one that allowed us

571
00:28:11,020 --> 00:28:14,430
to kind of look at the data in real time.

572
00:28:14,430 --> 00:28:16,650
- And we created an
image that way on paper

573
00:28:16,650 --> 00:28:19,730
faster than they could
reconstruct the picture

574
00:28:19,730 --> 00:28:20,893
in a computer.

575
00:28:23,030 --> 00:28:26,030
That first picture was from us engineers

576
00:28:26,030 --> 00:28:28,740
trying to figure out if the
tape recorder was working

577
00:28:28,740 --> 00:28:31,943
because our bosses were saying,
what do we tell the press?

578
00:28:33,089 --> 00:28:35,930
That's where the big pressure was.

579
00:28:35,930 --> 00:28:38,190
And at the point where some people noticed

580
00:28:38,190 --> 00:28:41,040
we were starting to
put a picture together,

581
00:28:41,040 --> 00:28:42,980
they put a guy in charge of security

582
00:28:42,980 --> 00:28:44,680
to keep people away from the door.

583
00:28:45,820 --> 00:28:47,560
But people kept wandering in.

584

00:28:47,560 --> 00:28:48,860
So the word was spreading.

585
00:28:49,737 --> 00:28:52,404
(ominous music)

586
00:29:00,370 --> 00:29:02,710
Some people wanted to
stop us from doing that

587
00:29:02,710 --> 00:29:07,710
because we would circumvent
the PR release of pictures

588
00:29:07,880 --> 00:29:08,713
if any.

589
00:29:09,940 --> 00:29:12,050
We said we're interested
in the engineering

590
00:29:12,050 --> 00:29:13,540
and not the pictures.

591
00:29:13,540 --> 00:29:15,358
So they allowed us to continue.

592
00:29:15,358 --> 00:29:18,025
(ominous music)

593
00:29:19,410 --> 00:29:22,010
We then had enough fans collecting

594
00:29:22,010 --> 00:29:24,110
and our immediate bosses said, keep going.

595
00:29:24,979 --> 00:29:28,062
(indistinct chatter)

596
00:29:33,036 --> 00:29:34,953
- Hey, that's gorgeous.

597
00:29:38,010 --> 00:29:42,358
- As you know, the more formal
processing of these pictures

598
00:29:42,358 --> 00:29:43,275
is taking place.

599
00:29:45,170 --> 00:29:46,890
- Dr. Leighton from Catech

600
00:29:46,890 --> 00:29:48,360
came in and looked at it.

601
00:29:48,360 --> 00:29:50,290
He really understood the data.

602
00:29:50,290 --> 00:29:53,670
He quickly picked up that
the darkest of our numbers

603
00:29:53,670 --> 00:29:56,800
was actually the black from space.

604
00:29:56,800 --> 00:29:58,240
And he said, there's the limb.

605
00:29:58,240 --> 00:30:00,633
And he could start to look at the picture

606
00:30:00,633 --> 00:30:02,650
and he looked like a happy camper.

607
00:30:02,650 --> 00:30:07,170
So it's been a lot of fun
because it was accidentally

608
00:30:07,170 --> 00:30:09,083
kind of the first picture of Mars.

609
00:30:10,291 --> 00:30:12,958
(ominous music)

610
00:30:17,486 --> 00:30:18,940
(machine whirring)

611
00:30:18,940 --> 00:30:21,610
- [Narrator] Eventually the
first real close up picture

612
00:30:21,610 --> 00:30:23,203
of Mars was processed.

613
00:30:24,597 --> 00:30:27,514
(machine whirring)

614
00:30:32,240 --> 00:30:35,280
It was brought into the
imaging team's inner sanctum

615
00:30:35,280 --> 00:30:38,653
and laid in front of the
scientists face down.

616
00:30:41,700 --> 00:30:44,340
They were shocked by what they saw.

617
00:30:44,340 --> 00:30:46,293
Or what they didn't see.

618
00:30:54,030 --> 00:30:56,440
- Everything was kind of very secretive.

619
00:30:56,440 --> 00:30:58,200

I'm not sure I exactly know why.

620
00:30:58,200 --> 00:31:00,910
There were only about five
people on that imaging team.

621
00:31:00,910 --> 00:31:03,040
And somebody came running over to get me

622
00:31:03,040 --> 00:31:05,770
because I had also developed
the software program

623
00:31:05,770 --> 00:31:08,530
that would predict exactly
where the first picture

624
00:31:08,530 --> 00:31:10,120
would be taken and where each
of the subsequent pictures

625
00:31:10,120 --> 00:31:11,633
would be taken at Mars.

626
00:31:12,884 --> 00:31:13,717
And so they came over

627
00:31:13,717 --> 00:31:14,700
and I had to go over to this little room

628
00:31:14,700 --> 00:31:16,400
and I knocked on the door
and that door opened.

629
00:31:16,400 --> 00:31:18,878
They grabbed me and pulled
me in and they said,

630
00:31:18,878 --> 00:31:21,880

"What does the first picture
supposed to look like?"

631
00:31:21,880 --> 00:31:24,040
I said, "Well, I don't know."

632
00:31:24,040 --> 00:31:26,770
But they said, "No, I mean, is
it going to be on the planet

633
00:31:26,770 --> 00:31:28,063
or off the planet?"

634
00:31:28,063 --> 00:31:30,270
And I said, "Well, it
should be about on the limb.

635
00:31:30,270 --> 00:31:32,090
It should be about half on and half off."

636
00:31:32,090 --> 00:31:33,988
"Oh, good. Thanks. Goodbye."

637
00:31:33,988 --> 00:31:35,540
Out the door I went.

638
00:31:35,540 --> 00:31:36,850
I think they were a little concerned

639
00:31:36,850 --> 00:31:38,750
that the first picture that popped up

640
00:31:38,750 --> 00:31:40,670
only had a part of Mars in it.

641
00:31:40,670 --> 00:31:43,105
But that's the way it was supposed to be.

642

00:31:43,105 --> 00:31:43,938
(soft music)

643
00:31:43,938 --> 00:31:47,940
- The lay public was very
interested in the photography

644
00:31:47,940 --> 00:31:49,840
that was coming back from the planets,

645
00:31:49,840 --> 00:31:52,000
which had been just points of light.

646
00:31:52,000 --> 00:31:54,820
And now we were discovering
that they were worlds

647
00:31:54,820 --> 00:31:55,770
in their own right.

648
00:31:57,250 --> 00:31:58,360
For awhile The WAG said

649
00:31:58,360 --> 00:32:01,330
JPL stood for "Just Pictures Laboratory"

650
00:32:01,330 --> 00:32:04,200
because imaging was such an integral part

651
00:32:04,200 --> 00:32:05,400
of most of our missions.

652
00:32:12,190 --> 00:32:14,780
- [Narrator] JPL had learned
with its missions to the Moon

653
00:32:14,780 --> 00:32:16,043
that pictures mattered.

654
00:32:17,760 --> 00:32:21,053
And now president Lyndon
Johnson wanted to see Mars.

655
00:32:23,090 --> 00:32:25,120
A White House briefing for Johnson

656
00:32:25,120 --> 00:32:28,090
and the passing out of medals
also afforded the opportunity

657
00:32:28,090 --> 00:32:29,930
to underscore to the world

658
00:32:29,930 --> 00:32:33,890
another U.S. accomplishment
in the race for space.

659
00:32:33,890 --> 00:32:35,480
- I think I speak for every American

660
00:32:35,480 --> 00:32:40,480
when I tell you how very
proud and how impressed

661
00:32:41,430 --> 00:32:44,490
how grateful we are for what you

662
00:32:44,490 --> 00:32:48,960
and all the many members of
your team have accomplished

663
00:32:48,960 --> 00:32:51,293
on the Mariner 4 mission.

664
00:32:54,232 --> 00:32:58,387
It may just be that life as we know it

665

00:33:00,460 --> 00:33:01,810
is more unique

666
00:33:03,790 --> 00:33:05,073
than many have thought.

667
00:33:06,193 --> 00:33:08,780
(soft music)

668
00:33:08,780 --> 00:33:09,920
- [Narrator] Johnson's comments

669
00:33:09,920 --> 00:33:11,830
about the uniqueness of life

670
00:33:11,830 --> 00:33:15,910
were referencing these first
closeup pictures of Mars.

671
00:33:15,910 --> 00:33:19,110
However fuzzy, they revealed
a Mars far different

672
00:33:19,110 --> 00:33:20,653
from what had been expected.

673
00:33:22,527 --> 00:33:25,070
- The best pictures
showed a cratered surface,

674
00:33:25,070 --> 00:33:28,633
which had to date back to three
or four billion years old.

675
00:33:29,930 --> 00:33:32,540
And that was so at variance
with what we expected

676
00:33:32,540 --> 00:33:34,140

that everybody was very shocked.

677
00:33:35,710 --> 00:33:38,320
- [Narrator] The Martian
surface was ancient.

678
00:33:38,320 --> 00:33:40,780
There were no signs of mountains.

679
00:33:40,780 --> 00:33:41,890
No canals.

680
00:33:41,890 --> 00:33:45,113
No flowing water and no vegetation.

681
00:33:45,970 --> 00:33:49,403
Any hope of life on the surface was gone.

682
00:33:54,674 --> 00:33:57,091
(soft music)

683
00:34:01,267 --> 00:34:02,940
At the beginning of the space race

684
00:34:02,940 --> 00:34:05,080
JPL had proposed to NASA

685
00:34:05,080 --> 00:34:08,300
an ambitious plan to send
an armada of spacecraft

686
00:34:08,300 --> 00:34:10,970
sweeping across the solar system.

687
00:34:10,970 --> 00:34:15,193
Now JPL knew how hard it really
was to reach another planet.

688

00:34:17,880 --> 00:34:19,750
Yet in a reversal of roles

689
00:34:19,750 --> 00:34:23,190
NASA was now pushing for bold missions.

690
00:34:23,190 --> 00:34:25,910
The agency wondered:
might the massive rockets

691
00:34:25,910 --> 00:34:28,280
needed to launch astronauts to the Moon

692
00:34:28,280 --> 00:34:31,770
be used for robotic
missions to the planets?

693
00:34:31,770 --> 00:34:34,403
- The idea gained favor
in NASA headquarters

694
00:34:35,315 --> 00:34:38,280
that the next mission would be a Saturn 5

695
00:34:39,275 --> 00:34:40,453
to Mars.

696
00:34:41,920 --> 00:34:45,030
And that meant that the 575 pounds

697
00:34:45,030 --> 00:34:47,510
that we were able to send, the Mariner 4,

698
00:34:47,510 --> 00:34:48,968
that it'd be succeeded

699
00:34:48,968 --> 00:34:53,351
by a 50,000 pound payload in one leap.

700
00:34:54,450 --> 00:34:56,640
This is insane.

701
00:34:56,640 --> 00:35:00,153
- Two large spacecraft
with entry capsules.

702
00:35:00,153 --> 00:35:04,700
Two of them all sat on
top of a big Saturn 5.

703
00:35:04,700 --> 00:35:07,563
It was monstrous.

704
00:35:08,687 --> 00:35:10,570
(soft music)

705
00:35:10,570 --> 00:35:11,750
- [Narrator] Orbiters would circle

706
00:35:11,750 --> 00:35:13,493
and map the planet in detail

707
00:35:14,460 --> 00:35:17,293
while landers would search
for life on the surface.

708
00:35:18,600 --> 00:35:21,240
- It was very fortunate for all of us

709
00:35:21,240 --> 00:35:24,133
and everybody that that
thing got canceled.

710
00:35:25,940 --> 00:35:29,060
- [Narrator] These were to
be mere precursor missions.

711

00:35:29,060 --> 00:35:32,870
Astronauts, NASA dreamt, would
put their footprints on Mars

712
00:35:32,870 --> 00:35:34,800
in the late 1980s.

713
00:35:40,630 --> 00:35:42,200
In 1969

714
00:35:42,200 --> 00:35:44,420
two Mariners, numbered six and seven,

715
00:35:44,420 --> 00:35:46,453
managed to survive their launches.

716
00:35:47,830 --> 00:35:48,760
For the first time

717
00:35:48,760 --> 00:35:52,503
JPL was flying two spacecraft
to the same destination.

718
00:35:57,700 --> 00:36:00,370
The Soviet Union had the same idea

719
00:36:00,370 --> 00:36:03,153
but both of their missions
failed during launch.

720
00:36:05,591 --> 00:36:07,130
(soft music)

721
00:36:07,130 --> 00:36:08,700
Following a five month cruise

722
00:36:08,700 --> 00:36:12,080
the Mariners were fast
approaching their destination

723
00:36:12,080 --> 00:36:15,280
and excitement among the
engineers was building.

724
00:36:15,280 --> 00:36:16,780
- It's just great.

725
00:36:16,780 --> 00:36:20,681
It's like being on the bridge
of the star ship Enterprise.

726
00:36:20,681 --> 00:36:23,323
Only that didn't exist yet.

727
00:36:24,220 --> 00:36:27,599
You can place your mind

728
00:36:27,599 --> 00:36:29,637
where you think you are in the spacecraft

729
00:36:29,637 --> 00:36:32,170
and every command you
send to the spacecraft

730
00:36:32,170 --> 00:36:33,823
you can imagine what it's doing.

731
00:36:35,327 --> 00:36:39,810
I'm out there in the darkness
of space with the spacecraft.

732
00:36:39,810 --> 00:36:43,940
And I'm seeing, just like
the camera is seeing, Mars

733
00:36:43,940 --> 00:36:44,773
hanging there.

734
00:36:44,773 --> 00:36:46,800
And that's our destination.

735
00:36:46,800 --> 00:36:47,700
We're going there.

736
00:36:51,610 --> 00:36:53,950
- [Narrator] 50 hours
before closest approach

737
00:36:53,950 --> 00:36:57,393
Mariner 6 turned on its science
instruments and cameras.

738
00:36:58,634 --> 00:37:00,617
- [Astronaut] Okay, that's great

739
00:37:00,617 --> 00:37:03,160
- [Narrator] Only nine
days before Neil Armstrong

740
00:37:03,160 --> 00:37:05,313
and Buzz Aldrin had landed on the moon.

741
00:37:08,700 --> 00:37:12,560
But in Pasadena, there
was no time to celebrate.

742
00:37:12,560 --> 00:37:15,293
Mariner 6 was already beaming back data.

743
00:37:18,140 --> 00:37:20,953
And following right behind was Mariner 7.

744
00:37:23,050 --> 00:37:25,690
Advances in technology
had greatly improved

745

00:37:25,690 --> 00:37:28,220
the turnaround time for pictures.

746
00:37:28,220 --> 00:37:30,020
Instead of sitting in a back room

747
00:37:30,020 --> 00:37:32,690
Robert Leighton was now at a TV console

748
00:37:32,690 --> 00:37:35,130
offering to the world instant reactions

749
00:37:35,130 --> 00:37:37,590
as images of Mars reached Earth.

750
00:37:37,590 --> 00:37:40,200
- I see the picture developing here.

751
00:37:40,200 --> 00:37:44,073
So here is our first view
of Mars since Mariner 4.

752
00:37:46,880 --> 00:37:49,450
I see some interesting light areas

753
00:37:50,744 --> 00:37:52,083
near the upper limb.

754
00:37:53,435 --> 00:37:55,540
There's some bright areas
near the afternoon limb,

755
00:37:55,540 --> 00:37:56,990
the upper limb of the planet,

756
00:37:58,390 --> 00:38:00,190
as you see them on the screen there.

757

00:38:02,220 --> 00:38:03,680
- [Narrator] Compared with pictures

758
00:38:03,680 --> 00:38:05,970
a science instrument
on board the spacecraft

759
00:38:05,970 --> 00:38:09,460
called an infrared spectrometer
was easily overlooked

760
00:38:09,460 --> 00:38:10,423
by the public.

761
00:38:11,340 --> 00:38:13,660
Its purpose was to measure
the chemical makeup

762
00:38:13,660 --> 00:38:15,800
of the Martian atmosphere.

763
00:38:15,800 --> 00:38:16,720
With this instrument

764
00:38:16,720 --> 00:38:19,360
it might be possible to
detect evidence of life,

765
00:38:19,360 --> 00:38:22,043
if it existed, in the form of methane.

766
00:38:23,330 --> 00:38:25,390
On Earth this organic compound

767
00:38:25,390 --> 00:38:27,973
can be produced by microorganisms.

768
00:38:29,180 --> 00:38:32,450
Finding methane on Mars would

be a scientific discovery

769
00:38:32,450 --> 00:38:34,713
carrying tremendous implications.

770
00:38:35,840 --> 00:38:37,560
But there was a conflict.

771
00:38:37,560 --> 00:38:40,200
The TV cameras and the
infrared spectrometer

772
00:38:40,200 --> 00:38:42,780
were mounted on the
same scanning platform,

773
00:38:42,780 --> 00:38:45,853
which meant both had to be
pointed in the same direction.

774
00:38:47,100 --> 00:38:51,123
Scientists were at odds
about where and when to aim.

775
00:38:54,920 --> 00:38:57,150
- The value judgment in
this, and also for seven,

776
00:38:57,150 --> 00:38:58,910
is what indeed you see
in the [indistinct].

777
00:38:58,910 --> 00:39:00,350
As you point out none of you have seen it.

778
00:39:00,350 --> 00:39:01,183
You don't know.

779
00:39:01,183 --> 00:39:02,650

Well, that could be the
most exciting thing of all.

780
00:39:02,650 --> 00:39:03,483
Because no one

781
00:39:03,483 --> 00:39:04,316
mentioned the difference-
- Yeah, but this could

782
00:39:04,316 --> 00:39:05,149
be the most exciting

783
00:39:05,149 --> 00:39:07,000
and that's the place where
we'll get the best information

784
00:39:07,000 --> 00:39:07,833
on both flights.

785
00:39:07,833 --> 00:39:08,666
- No, no, no we can't do that.
- I think you fail

786
00:39:08,666 --> 00:39:10,280
to appreciate the point
I was trying to make.

787
00:39:10,280 --> 00:39:12,250
Is that the you're
costing us eight pictures

788
00:39:12,250 --> 00:39:13,083
on the bright side of seven.

789
00:39:13,083 --> 00:39:15,220
But is-
- Come on.

790

00:39:15,220 --> 00:39:16,129
- Hear me out.

791
00:39:16,129 --> 00:39:17,390
(indistinct crosstalk)

792
00:39:17,390 --> 00:39:19,200
Hear me out, please.

793
00:39:19,200 --> 00:39:20,470
Because the argument is canonic

794
00:39:20,470 --> 00:39:22,320
to the same kind of argument.

795
00:39:22,320 --> 00:39:23,610
You don't know what you're going to see.

796
00:39:23,610 --> 00:39:25,610
Bob is unimpressed with what
you're going to see there.

797
00:39:25,610 --> 00:39:26,510
I am too.

798
00:39:26,510 --> 00:39:29,300
- I was unimpressed with
what we saw last night.

799
00:39:29,300 --> 00:39:31,193
But I think you had to look.

800
00:39:31,193 --> 00:39:33,440
I think the issue that now is opened is

801
00:39:33,440 --> 00:39:34,910
whether you should look again.

802

00:39:34,910 --> 00:39:37,470
Just because it [indistinct]
encounter you don't see it,

803
00:39:37,470 --> 00:39:39,610
but you're going to want to look again.

804
00:39:39,610 --> 00:39:40,760
- May I finish, please?

805
00:39:41,760 --> 00:39:43,090
- Do we have that much time?

806
00:39:43,090 --> 00:39:45,250
- [Narrator] This debate
was an early example

807
00:39:45,250 --> 00:39:48,690
of what would become a classic
dilemma for scientists.

808
00:39:48,690 --> 00:39:51,100
Multiple instruments on a spacecraft

809
00:39:51,100 --> 00:39:54,060
often meant conflicting desires.

810
00:39:54,060 --> 00:39:56,400
And not every hope could be fulfilled,

811
00:39:56,400 --> 00:39:59,733
especially with flyby missions
lasting only a few hours.

812
00:40:00,676 --> 00:40:02,967
- Two degrees south, three degrees south,

813
00:40:02,967 --> 00:40:03,963
one picture longer.

814
00:40:04,980 --> 00:40:07,190
- [Narrator] These
scientists had invested years

815
00:40:07,190 --> 00:40:09,554
preparing for this mission.

816
00:40:09,554 --> 00:40:13,590
For some their professional
careers were at stake.

817
00:40:13,590 --> 00:40:16,569
The expectations, especially
given time constraints,

818
00:40:16,569 --> 00:40:18,073
were enormous.

819
00:40:19,156 --> 00:40:21,960
This was especially
true for George Pimentel

820
00:40:21,960 --> 00:40:25,540
of the University of
California at Berkeley.

821
00:40:25,540 --> 00:40:27,420
Two years before he had come close

822
00:40:27,420 --> 00:40:31,210
to becoming one of NASA's
first scientist astronauts.

823
00:40:31,210 --> 00:40:33,860
His dream was to go to Mars.

824
00:40:33,860 --> 00:40:37,210
But Pimentel failed the

agency's stringent physical exam

825
00:40:37,210 --> 00:40:39,093
due to a minor vision problem.

826
00:40:40,030 --> 00:40:43,330
Now he was determined to
go to Mars in another way

827
00:40:43,330 --> 00:40:45,083
through his science instrument.

828
00:40:45,980 --> 00:40:50,310
A maverick, Pimentel had already
clashed with JPL engineers

829
00:40:50,310 --> 00:40:52,590
over technical standards.

830
00:40:52,590 --> 00:40:54,563
He was not averse to conflict.

831
00:40:55,440 --> 00:40:59,040
Lore has it that when a JPL
quality control engineer

832
00:40:59,040 --> 00:41:02,180
once visited Pimentel's Berkeley lab

833
00:41:02,180 --> 00:41:04,183
a fistfight had broken out.

834
00:41:06,510 --> 00:41:10,420
And now at this critical hour,
for some unexplained reason,

835
00:41:10,420 --> 00:41:13,973
his spectrometer on Mariner 6
had partially malfunctioned.

836
00:41:15,590 --> 00:41:17,480
Some data was captured.

837
00:41:17,480 --> 00:41:20,250
It seemed to indicate
a remarkable finding:

838
00:41:20,250 --> 00:41:23,997
water in the form of ice
at the south polar cap.

839
00:41:25,064 --> 00:41:25,960
- Ice?

840
00:41:25,960 --> 00:41:27,132
- Yeah.
- H20?

841
00:41:27,132 --> 00:41:28,351
- Yeah, all right.

842
00:41:28,351 --> 00:41:29,822
- You think there's water ice...

843
00:41:29,822 --> 00:41:30,655
- Pardon me?

844
00:41:30,655 --> 00:41:31,488
- Do you really think-

845
00:41:31,488 --> 00:41:33,800
- There's no question about it being ice.

846
00:41:33,800 --> 00:41:36,660
- [Narrator] Finding water
in the form of ice, if true,

847

00:41:36,660 --> 00:41:38,453
would be a huge discovery.

848
00:41:41,360 --> 00:41:44,373
But everyone else's attention
was soon drawn elsewhere.

849
00:41:46,320 --> 00:41:51,320
- The encounters were not very
far apart, just a few days.

850
00:41:52,890 --> 00:41:56,100
So we had two spacecraft to monitor.

851
00:41:56,100 --> 00:41:59,620
And it turned out that while the first one

852
00:41:59,620 --> 00:42:01,800
was in the encounter phase,

853
00:42:01,800 --> 00:42:04,377
we had some emergencies on the second one.

854
00:42:05,530 --> 00:42:08,486
- So we were taking
pictures during approach.

855
00:42:08,486 --> 00:42:12,960
We're in the middle of
our approach sequence.

856
00:42:12,960 --> 00:42:17,543
And somebody says, "Hey,
Mariner 7 disappeared."

857
00:42:21,130 --> 00:42:23,957
- Without data we are kind
of a little bit blind.

858

00:42:27,090 --> 00:42:29,410
- [Narrator] When contact
was re-established

859
00:42:29,410 --> 00:42:31,870
engineers were stunned
to find that something

860
00:42:31,870 --> 00:42:35,283
had caused Mariner 7 to go
cartwheeling through space.

861
00:42:36,210 --> 00:42:37,043
But what?

862
00:42:38,569 --> 00:42:41,060
- [Engineer] Stand by and keep looking

863
00:42:41,060 --> 00:42:43,650
and if you see a signal call it out.

864
00:42:43,650 --> 00:42:46,520
And we'll see what we can do.

865
00:42:46,520 --> 00:42:48,277
- [Astronaut] I don't
want to discourage you

866
00:42:48,277 --> 00:42:52,860
but they may not see
pictures of (indistinct)

867
00:42:52,860 --> 00:42:55,960
- [Narrator] Amazingly engineers
managed to regain control

868
00:42:55,960 --> 00:42:57,523
of the crippled spacecraft.

869

00:42:58,480 --> 00:43:01,603
But what had caused the
disruption remained unknown.

870
00:43:04,920 --> 00:43:07,900
- So it was a very hectic
time, as I remember,

871
00:43:07,900 --> 00:43:10,960
in trying to handle the
very complex operation

872
00:43:10,960 --> 00:43:12,680
on the first one

873
00:43:12,680 --> 00:43:15,573
along with the emergency
on the second one.

874
00:43:16,707 --> 00:43:18,407
- We don't know what the problem is?

875
00:43:20,657 --> 00:43:22,324
Unscramble the data.

876
00:43:23,700 --> 00:43:25,810
- [Narrator] A possible
cause was Pimentel's

877
00:43:25,810 --> 00:43:27,453
troublesome spectrometer.

878
00:43:29,020 --> 00:43:32,513
It required a pressurized
canister of coolant gases.

879
00:43:34,060 --> 00:43:37,240
A container explosion
would explain Mariner 7's

880
00:43:37,240 --> 00:43:38,923
near catastrophic event.

881
00:43:40,960 --> 00:43:43,880
As the second Mariner bore down on Mars

882
00:43:43,880 --> 00:43:47,570
Pimentel's instrument
became the prime suspect.

883
00:43:47,570 --> 00:43:50,070
- No, the JPL people
are the ones who think

884
00:43:50,070 --> 00:43:53,090
that something went wrong
with our gas system.

885
00:43:53,090 --> 00:43:56,640
The problem is there's no probable theory

886
00:43:56,640 --> 00:43:58,370
as to what could have done what

887
00:43:58,370 --> 00:44:00,023
has apparently happened to it.

888
00:44:02,905 --> 00:44:04,330
And so there's a natural tendency

889
00:44:04,330 --> 00:44:05,610
to look at our gas bottles

890
00:44:05,610 --> 00:44:08,800
because they are capable
of doing a lot of damage.

891
00:44:08,800 --> 00:44:10,570

Well, after a Mariner 7 arrival,

892
00:44:10,570 --> 00:44:11,920
I may want to go to Russia.

893
00:44:13,610 --> 00:44:15,530
- [Narrator] Just before final approach

894
00:44:15,530 --> 00:44:18,440
engineers commanded the
spectrometer to turn on

895
00:44:18,440 --> 00:44:20,020
and cool down.

896
00:44:20,020 --> 00:44:21,600
- The real moment is
when you see what happens

897
00:44:21,600 --> 00:44:26,600
when the signal to start cooling
down the IRS occurs, right?

898
00:44:30,341 --> 00:44:34,258
And we'll see whether...
which prediction was right.

899
00:44:35,810 --> 00:44:38,200
- [Narrator] If the
spectrometer failed to cool

900
00:44:38,200 --> 00:44:40,263
engineers would have their smoking gun.

901
00:44:42,259 --> 00:44:43,592
- Come on, baby.

902
00:44:48,483 --> 00:44:53,483
This time it's fast enough.

It had a really good DC49.

903
00:44:54,040 --> 00:44:55,690
- [Narrator] Reports from mission control

904
00:44:55,690 --> 00:44:57,743
appeared to be good news for Pimentel.

905
00:45:03,805 --> 00:45:05,472
- That's number one.

906
00:45:07,157 --> 00:45:08,313
That's big news.

907
00:45:10,452 --> 00:45:11,285
The [indistinct] got current.

908
00:45:11,285 --> 00:45:12,243
- [Engineer] They got current?

909
00:45:13,275 --> 00:45:16,442
(indistinct dialogue)

910
00:45:27,240 --> 00:45:28,073
- We have what?

911
00:45:31,460 --> 00:45:34,113
Well, they think the bottles didn't go?

912
00:45:38,812 --> 00:45:40,462
(indistinct radio chatter)

913
00:45:40,462 --> 00:45:44,128
Attitude control reports no
effect from the pyro event.

914
00:45:50,340 --> 00:45:51,940
That's what's known as bad news.

915
00:45:51,940 --> 00:45:52,840
- [Engineer] Yeah.

916
00:45:55,310 --> 00:45:57,828
- If we don't hear something
in a couple of minutes

917
00:45:57,828 --> 00:45:58,661
we've had it.

918
00:46:15,846 --> 00:46:17,412
God, you're cursing us.

919
00:46:17,412 --> 00:46:19,662
(laughing)

920
00:46:25,509 --> 00:46:27,592
(cheers)

921
00:46:34,100 --> 00:46:37,350
(indistinct clamoring)

922
00:46:58,400 --> 00:47:00,250
- [Narrator] While a relieved Pimentel

923
00:47:00,250 --> 00:47:02,563
celebrated his instrument's innocence,

924
00:47:03,420 --> 00:47:06,080
Leighton continued sharing
aloud possibilities

925
00:47:06,080 --> 00:47:07,443
about what he was seeing.

926
00:47:09,010 --> 00:47:10,460
- [Leighton] What a

view, huh? What a view!

927
00:47:12,100 --> 00:47:15,400
Incidentally, I think a view
like that must convince one

928
00:47:16,497 --> 00:47:18,790
that that deposit on the polar cap

929
00:47:18,790 --> 00:47:22,230
must be more than a
fraction of a millimeter.

930
00:47:22,230 --> 00:47:24,660
- [Narrator] Was the southern
polar cap made of water

931
00:47:24,660 --> 00:47:26,993
as Pimentel's instrument had indicated?

932
00:47:28,310 --> 00:47:32,203
Or were these layers of
carbon dioxide, dry ice?

933
00:47:33,720 --> 00:47:36,480
For anyone hoping to find life on Mars

934
00:47:36,480 --> 00:47:38,653
water was the preferred answer.

935
00:47:40,310 --> 00:47:42,480
- We'll be back tomorrow at 5:00.

936
00:47:42,480 --> 00:47:44,560
- [Narrator] Pimentel
with data in his hands

937
00:47:44,560 --> 00:47:47,363
departed for home to pore

over the measurements.

938
00:47:48,530 --> 00:47:49,680
Later from Berkeley

939
00:47:49,680 --> 00:47:51,400
he took part in a conference call

940
00:47:51,400 --> 00:47:53,333
in preparation for a press briefing.

941
00:47:54,210 --> 00:47:58,160
A teasing Pimentel hinted of
a blockbuster announcement.

942
00:47:58,160 --> 00:47:59,790
- I'm curious, was that a hint

943
00:47:59,790 --> 00:48:02,181
that you think you're
seeing something organic?

944
00:48:02,181 --> 00:48:03,864
- [Pimentel] Oh yeah.

945
00:48:03,864 --> 00:48:05,440
- You think you are.

946
00:48:05,440 --> 00:48:06,868
- [Pimentel] Are you saying
you're curious or furious.

947
00:48:06,868 --> 00:48:08,190
- Curious.

948
00:48:08,190 --> 00:48:09,390
- [Pimentel] Well, curious.

949

00:48:09,390 --> 00:48:11,630
That's optimistic mode right now.

950
00:48:11,630 --> 00:48:15,253
- [Narrator] Organics meant the
possibility of life on Mars.

951
00:48:16,758 --> 00:48:18,253
- [Pimentel] It's quiet down there.

952
00:48:19,982 --> 00:48:21,032
It's quiet out there.

953
00:48:22,390 --> 00:48:25,710
- [Don] What are the wavelengths
of your organic bands?

954
00:48:25,710 --> 00:48:27,318
- [Pimentel] We'll see tomorrow, Don.

955
00:48:27,318 --> 00:48:29,314
- [Don] You don't want to tell us now?

956
00:48:29,314 --> 00:48:30,373
- [Pimentel] Right.

957
00:48:30,373 --> 00:48:33,910
I can see you didn't expect
to find her teeming with life.

958
00:48:35,309 --> 00:48:36,460
That's supposed to be a joke.

959
00:48:36,460 --> 00:48:37,510
- [Don] Yeah, I know.

960
00:48:40,070 --> 00:48:41,960
- [Narrator] Pimentel's
teasing left the others

961
00:48:41,960 --> 00:48:43,060
not only in the dark

962
00:48:43,060 --> 00:48:44,323
but deeply puzzled.

963
00:48:45,360 --> 00:48:46,780
All the other science results

964
00:48:46,780 --> 00:48:49,333
pointed to an entirely
different conclusion.

965
00:48:51,650 --> 00:48:55,430
And at the JPL press conference,
one scientist after another

966
00:48:55,430 --> 00:48:58,663
presented a picture of
a barren lifeless Mars.

967
00:49:01,030 --> 00:49:02,933
Until the last speaker.

968
00:49:04,020 --> 00:49:05,270
- We were up

969
00:49:05,270 --> 00:49:09,753
Dr. [Indistinct] and I,
almost all night last night

970
00:49:09,753 --> 00:49:12,730
with our computer, trying
to analyze our data.

971
00:49:12,730 --> 00:49:16,650
And I'm telling you the results
as our instrument indicates.

972
00:49:16,650 --> 00:49:19,960
And in so far as we may later prove

973
00:49:19,960 --> 00:49:21,290
to have to retract something

974
00:49:21,290 --> 00:49:23,570
and that's the nature of science.

975
00:49:23,570 --> 00:49:26,800
I'm telling you what our data indicate.

976
00:49:26,800 --> 00:49:31,800
We are confident that we
have detected gaseous methane

977
00:49:32,010 --> 00:49:34,943
and gaseous ammonia on Mars.

978
00:49:36,020 --> 00:49:39,000
- [Narrator] Being confident
of having found methane

979
00:49:39,000 --> 00:49:42,130
was all but another way of
saying there was evidence of life

980
00:49:42,130 --> 00:49:43,751
on Mars.

981
00:49:43,751 --> 00:49:46,430
But Pimentel was not done.

982
00:49:46,430 --> 00:49:48,970
His instrument also pointed
to that key ingredient

983

00:49:48,970 --> 00:49:50,480
needed for life,

984
00:49:50,480 --> 00:49:51,510
water.

985
00:49:51,510 --> 00:49:54,380
- Our data are consistent with

986
00:49:54,380 --> 00:49:58,610
and suggest that the polar
cap is composed of water ice

987
00:49:58,610 --> 00:50:01,710
and probably not solid CO2.

988
00:50:01,710 --> 00:50:04,460
In the region near the
edge of the polar cap

989
00:50:04,460 --> 00:50:06,833
polar ice provides a reservoir of water.

990
00:50:07,800 --> 00:50:10,590
The solid carbon dioxide cloud

991
00:50:10,590 --> 00:50:14,030
provides protection from
ultraviolet radiation.

992
00:50:14,030 --> 00:50:17,273
A region certainly deserving
further exploration.

993
00:50:23,015 --> 00:50:26,015
(audience applaud)

994
00:50:31,630 --> 00:50:32,633
- Thank you, George.

995
00:50:33,960 --> 00:50:36,283
I think you now see why science is fun.

996
00:50:39,180 --> 00:50:41,290
- [Narrator] As Pimentel had cautioned

997
00:50:41,290 --> 00:50:43,370
the nature of science is that knowledge

998
00:50:43,370 --> 00:50:45,513
is subject to new findings.

999
00:50:46,370 --> 00:50:48,820
He, like others, had
rushed to share results

1000
00:50:48,820 --> 00:50:53,083
virtually overnight with a
public eager for instant science.

1001
00:50:55,090 --> 00:50:57,150
But responding so quickly was risky

1002
00:50:58,150 --> 00:51:01,500
and ran counter to the science
tradition of critical review.

1003
00:51:04,930 --> 00:51:07,700
And Pimentel and the
others took other chances

1004
00:51:07,700 --> 00:51:10,750
in allowing cameras to
witness science in the making

1005
00:51:10,750 --> 00:51:11,923
warts and all.

1006
00:51:13,320 --> 00:51:15,720
Very few scientists in the years since

1007
00:51:15,720 --> 00:51:17,403
have been so transparent.

1008
00:51:18,970 --> 00:51:21,070
In Pimentel's case he soon realized

1009
00:51:21,070 --> 00:51:23,033
one of his findings was flawed.

1010
00:51:24,270 --> 00:51:27,270
The spectrometer had not
distinguished between methane

1011
00:51:27,270 --> 00:51:28,343
and CO2.

1012
00:51:29,300 --> 00:51:32,180
He quickly and publicly
announced the error.

1013
00:51:32,180 --> 00:51:35,930
And with that life on Mars was once again

1014
00:51:35,930 --> 00:51:37,993
an unsolved question.

1015
00:51:39,950 --> 00:51:43,330
As for the mystery of what
had gone wrong with Mariner 7

1016
00:51:43,330 --> 00:51:45,690
an investigation traced the probable cause

1017
00:51:45,690 --> 00:51:47,592
to a battery explosion.

1018
00:51:47,592 --> 00:51:50,259
(ominous music)

1019
00:51:52,660 --> 00:51:57,140
Mariners 6 and 7 had
imaged nearly 20% of Mars.

1020
00:51:57,140 --> 00:52:00,083
Piece by piece, the planet
was beginning to be known.

1021
00:52:03,790 --> 00:52:07,573
The ice caps were made of
water ice, not carbon dioxide.

1022
00:52:08,560 --> 00:52:10,270
The most discouraging discovery

1023
00:52:10,270 --> 00:52:12,280
for those hoping to find life

1024
00:52:12,280 --> 00:52:14,650
was learning that the
sun's lethal radiation

1025
00:52:14,650 --> 00:52:17,363
was reaching all the way
to the Martian surface.

1026
00:52:18,335 --> 00:52:20,320
(ominous music)

1027
00:52:20,320 --> 00:52:23,430
And once again, there
were images of craters,

1028
00:52:23,430 --> 00:52:25,913
but for some reason, not everywhere.

1029
00:52:29,070 --> 00:52:32,140
Mars seemed deserving of another look,

1030
00:52:32,140 --> 00:52:34,453
and more so than anyone realized.

1031
00:52:36,320 --> 00:52:37,650
By sheer chance

1032
00:52:37,650 --> 00:52:40,620
the paths of the twin Mariners
had not taken them in sight

1033
00:52:40,620 --> 00:52:43,243
of two gigantic geological features,

1034
00:52:44,200 --> 00:52:47,593
the largest of their kind
in the entire solar system.

1035
00:52:52,596 --> 00:52:55,096
(soft music)

1036
00:53:00,920 --> 00:53:04,550
The first great engineering
challenge in robotic exploration

1037
00:53:04,550 --> 00:53:08,093
was to fly by a destination
for a brief glimpse.

1038
00:53:11,130 --> 00:53:13,020
The next feat was to build a machine

1039
00:53:13,020 --> 00:53:15,603
capable of going into
orbit around a planet.

1040
00:53:18,670 --> 00:53:22,940
In 1971, the very next
opportunity to go to Mars,

1041
00:53:22,940 --> 00:53:25,390
JPL had taken the idea of an orbiter

1042
00:53:25,390 --> 00:53:27,913
from the drawing board to the launch pad.

1043
00:53:29,480 --> 00:53:32,963
- The basic spacecraft was
pretty much pure Mariner.

1044
00:53:34,100 --> 00:53:37,580
But it had this humongous
propulsion module on it

1045
00:53:37,580 --> 00:53:39,980
to slow the spacecraft
down when you got to Mars

1046
00:53:39,980 --> 00:53:43,490
to the point where it could
be captured by Mars' gravity.

1047
00:53:43,490 --> 00:53:46,130
That presented some
interesting challenges.

1048
00:53:46,130 --> 00:53:51,040
You had to store propellants
in space for nine months

1049
00:53:51,040 --> 00:53:53,410
and then use them and cross your fingers

1050
00:53:53,410 --> 00:53:56,173
and hope that everything worked

the way it was supposed to.

1051
00:53:57,062 --> 00:53:59,580
(rocket engine fires up)

1052
00:53:59,580 --> 00:54:03,020
- [Narrator] Once again, the
spacecraft were built in pairs.

1053
00:54:03,020 --> 00:54:05,497
It was prudent planning.
For yet another time,

1054
00:54:05,497 --> 00:54:07,340
the first mission failed

1055
00:54:07,340 --> 00:54:10,500
when the upper stage rocket malfunctioned.

1056
00:54:10,500 --> 00:54:11,940
- [Kennedy] This is
Kennedy launch control.

1057
00:54:11,940 --> 00:54:13,530
It appears from our preliminary data

1058
00:54:13,530 --> 00:54:15,240
here in the mission director center

1059
00:54:15,240 --> 00:54:18,500
that the Mars Mariner
mission has not succeeded.

1060
00:54:18,500 --> 00:54:20,870
We are standing by for further reports.

1061
00:54:20,870 --> 00:54:22,603
This is Kennedy launch control.

1062
00:54:25,787 --> 00:54:29,860
(rocket engine fires up)
(dramatic music)

1063
00:54:29,860 --> 00:54:32,540
- [Narrator] Mariner 9 had better fortune

1064
00:54:32,540 --> 00:54:34,763
and smoother sailing to Mars.

1065
00:54:36,869 --> 00:54:39,540
(dramatic music)

1066
00:54:39,540 --> 00:54:42,080
And this mission was not flying alone.

1067
00:54:42,080 --> 00:54:45,170
Just behind it were two Soviet probes.

1068
00:54:45,170 --> 00:54:47,780
These spacecraft were orbiters, too.

1069
00:54:47,780 --> 00:54:50,053
And the Soviets were raising the stakes.

1070
00:54:51,600 --> 00:54:54,350
Hitchhiking aboard each
spacecraft were landers

1071
00:54:54,350 --> 00:54:57,367
equipped with a TV camera,
science instruments

1072
00:54:57,367 --> 00:55:00,081
and a small shoe-box size rover.

1073
00:55:00,081 --> 00:55:02,831
(dramatic music)

1074
00:55:04,310 --> 00:55:06,770
All was well with all three spacecraft

1075
00:55:06,770 --> 00:55:09,770
as they neared the halfway
point of their journey.

1076
00:55:09,770 --> 00:55:13,963
But then Mars itself began
behaving in unusual ways.

1077
00:55:14,800 --> 00:55:17,330
- We're going to arrive in November

1078
00:55:17,330 --> 00:55:19,770
and in about August

1079
00:55:19,770 --> 00:55:22,130
the Earth-based astronomers
said something funny

1080
00:55:22,130 --> 00:55:24,190
is going on at Mars.

1081
00:55:24,190 --> 00:55:26,970
And within a week or two

1082
00:55:26,970 --> 00:55:29,343
there was a global dust storm on Mars.

1083
00:55:30,280 --> 00:55:31,620
When you normally look at Mars

1084
00:55:31,620 --> 00:55:34,080
you can see lots of dark and
light features and so forth

1085

00:55:34,080 --> 00:55:35,720
through a telescope.

1086
00:55:35,720 --> 00:55:37,270
It looked like a billiard ball.

1087
00:55:38,570 --> 00:55:39,930
We were now at August.

1088
00:55:39,930 --> 00:55:42,830
We were like two and a half
months before encounter.

1089
00:55:42,830 --> 00:55:44,610
We didn't know what to do.

1090
00:55:44,610 --> 00:55:47,200
We were beginning to feel
a little bitten, I think.

1091
00:55:47,200 --> 00:55:48,410
We'd lost Mariner 8.

1092
00:55:48,410 --> 00:55:50,990
We'd gotten everything
loaded into Mariner 9.

1093
00:55:50,990 --> 00:55:52,940
And now the planet's disappeared on us.

1094
00:55:53,950 --> 00:55:55,640
- [Narrator] As the dust storms swirled,

1095
00:55:55,640 --> 00:55:56,840
the three spacecraft--

1096
00:55:56,840 --> 00:55:59,993
one American, two
Russian--continued on their way.

1097
00:56:01,464 --> 00:56:04,380
On the evening before
Mariner arrived at Mars

1098
00:56:04,380 --> 00:56:07,290
Bruce Murray arranged
a symposium at Caltech

1099
00:56:08,260 --> 00:56:10,870
called "Mars and the Mind of Man".

1100
00:56:10,870 --> 00:56:13,540
The panel featured scientist Carl Sagan,

1101
00:56:13,540 --> 00:56:15,200
journalist Walter Sullivan

1102
00:56:15,200 --> 00:56:17,680
and science fiction
writers, Arthur C. Clark

1103
00:56:17,680 --> 00:56:18,783
and Ray Bradbury.

1104
00:56:19,940 --> 00:56:22,730
Murray labeled himself
the realist of the group.

1105
00:56:22,730 --> 00:56:26,340
The one doubtful that
Martian life might exist.

1106
00:56:26,340 --> 00:56:28,100
- So I became, in these debates

1107
00:56:28,100 --> 00:56:29,220
within the scientific community,

1108
00:56:29,220 --> 00:56:31,200
and sometimes in the public community,

1109
00:56:31,200 --> 00:56:32,033
the bad guy,

1110
00:56:32,033 --> 00:56:32,866
the black hat.

1111
00:56:32,866 --> 00:56:35,530
- Man as a human species

1112
00:56:35,530 --> 00:56:38,520
has been guilty of wishful
thinking collectively.

1113
00:56:38,520 --> 00:56:40,820
That they want it to be like the Earth.

1114
00:56:40,820 --> 00:56:44,830
This is a very deep seated
desire to find another place

1115
00:56:44,830 --> 00:56:46,590
where we can make another start

1116
00:56:46,590 --> 00:56:48,900
or could be somehow habitable.

1117
00:56:48,900 --> 00:56:52,440
And it's been very, very
hard to face up to the facts

1118
00:56:52,440 --> 00:56:55,400
which have emerged and have
been emerging for some time.

1119
00:56:55,400 --> 00:56:57,300

It really isn't that way.

1120
00:56:57,300 --> 00:57:00,070
That it is just wishful thinking.

1121
00:57:00,070 --> 00:57:01,770
- [Narrator] If Murray was the realist,

1122
00:57:01,770 --> 00:57:04,880
a buoyant Bradbury was a jubilant optimist

1123
00:57:04,880 --> 00:57:06,940
with a poetic message.

1124
00:57:06,940 --> 00:57:09,140
- I don't know what in
hell I'm doing here.

1125
00:57:10,190 --> 00:57:13,130
I'm the least scientific of all the people

1126
00:57:13,130 --> 00:57:14,860
up on the platform here today.

1127
00:57:14,860 --> 00:57:16,937
A 10 year old boy, a few
years ago, ran up to me

1128
00:57:16,937 --> 00:57:19,322
and said, Mr. Bradbury. I said, yes.

1129
00:57:19,322 --> 00:57:21,980
He said that book of yours,
the "Martian Chronicles".

1130
00:57:21,980 --> 00:57:22,813
I said, yes.

1131

00:57:22,813 --> 00:57:26,000
He says on page 92, I said yes.

1132
00:57:26,000 --> 00:57:28,330
He says, where you have the moons of Mars

1133
00:57:28,330 --> 00:57:29,840
rising in the East, I say yes,

1134
00:57:29,840 --> 00:57:30,876
He says, no.

1135
00:57:30,876 --> 00:57:33,876
(audience laughing)

1136
00:57:37,604 --> 00:57:40,628
(audience applaud)

1137
00:57:40,628 --> 00:57:43,060
I was hoping that during
the last few days,

1138
00:57:43,060 --> 00:57:46,323
as we got closer to Mars
and the dust cleared,

1139
00:57:46,323 --> 00:57:48,510
that we'd see a lot of
Martians standing there

1140
00:57:48,510 --> 00:57:51,380
with huge signs saying
"Bradbury was right".

1141
00:57:51,380 --> 00:57:54,238
(audience laughing)

1142
00:57:54,238 --> 00:57:57,238
(audience applaud)

1143
00:57:58,911 --> 00:58:00,361
Or even Clark.

1144
00:58:00,361 --> 00:58:03,918
(audience laughing)

1145
00:58:03,918 --> 00:58:05,990
And I've brought along today,

1146
00:58:05,990 --> 00:58:07,150
I'm gonna keep this short

1147
00:58:07,150 --> 00:58:08,810
because I'd much rather listen

1148
00:58:08,810 --> 00:58:11,440
to our scientific friends here today

1149
00:58:11,440 --> 00:58:13,450
tell us about what's coming up this week.

1150
00:58:13,450 --> 00:58:16,240
But every time I get a
group of people together

1151
00:58:16,240 --> 00:58:18,760
and have them trapped in a hall like this,

1152
00:58:18,760 --> 00:58:21,170
I bring a poem, see.

1153
00:58:21,170 --> 00:58:22,593
And you can't escape me.

1154
00:58:23,580 --> 00:58:24,890
Luckily it's a short poem,

1155
00:58:24,890 --> 00:58:27,180
but it sums up some of my feelings

1156
00:58:27,180 --> 00:58:28,760
on why I love space travel,

1157
00:58:28,760 --> 00:58:30,310
why I write science fiction,

1158
00:58:30,310 --> 00:58:33,940
why I'm intrigued with what's
going on this week at Mars.

1159
00:58:33,940 --> 00:58:38,940
And part of this has my philosophy
about space travel in it.

1160
00:58:39,040 --> 00:58:40,970
And if you'll permit, I'll read it to you.

1161
00:58:40,970 --> 00:58:42,737
It's very, very short.

1162
00:58:42,737 --> 00:58:44,617
"The fence we walked between the years

1163
00:58:44,617 --> 00:58:46,902
"did balance us serene.

1164
00:58:46,902 --> 00:58:49,337
"It was a place half in the
sky where in the green of leaf

1165
00:58:49,337 --> 00:58:51,157
"and promising of peach

1166
00:58:51,157 --> 00:58:52,587
"we'd reach our hand to touch it.

1167
00:58:52,587 --> 00:58:54,477
"Almost touch the sky.

1168
00:58:54,477 --> 00:58:56,527
"If we could reach and touch, we said

1169
00:58:56,527 --> 00:58:58,807
"it would teach us not to,

1170
00:58:58,807 --> 00:59:01,267
"never to be dead.

1171
00:59:01,267 --> 00:59:04,047
"We ate and almost touched that stuff.

1172
00:59:04,047 --> 00:59:05,927
"Our reach was never quite enough.

1173
00:59:05,927 --> 00:59:08,637
"If only we had taller
been and touched God's cuff

1174
00:59:08,637 --> 00:59:10,147
"his hem,

1175
00:59:10,147 --> 00:59:12,157
"we would not have to go with them

1176
00:59:12,157 --> 00:59:13,487
"who'd gone before

1177
00:59:13,487 --> 00:59:14,677
"a billion give or take

1178
00:59:14,677 --> 00:59:16,527
"a million boys or more

1179
00:59:16,527 --> 00:59:19,367
"who short as us stood
tall as they could stand

1180
00:59:19,367 --> 00:59:22,147
"and hoped by stretching tall

1181
00:59:22,147 --> 00:59:23,737
"that they might keep their land,

1182
00:59:23,737 --> 00:59:25,277
"their home, their hearth,

1183
00:59:25,277 --> 00:59:26,867
"their flesh and soul.

1184
00:59:26,867 --> 00:59:29,261
"But they like us were standing in a hole.

1185
00:59:29,261 --> 00:59:33,547
"Oh, Thomas will a race
one day stand really tall

1186
00:59:33,547 --> 00:59:34,537
"across the void,

1187
00:59:34,537 --> 00:59:36,237
"across the universe and all,

1188
00:59:36,237 --> 00:59:38,197
"and measure that with rocket fire

1189
00:59:38,197 --> 00:59:41,707
"at last put Adam's finger forth

1190
00:59:41,707 --> 00:59:43,557
"as on the Sistine ceiling

1191
00:59:43,557 --> 00:59:46,757
"and God's hand come down the other way

1192
00:59:46,757 --> 00:59:49,607
"to measure man and find him good

1193
00:59:49,607 --> 00:59:52,407
"and gift him with forever's day.

1194
00:59:52,407 --> 00:59:56,497
"I worked for that.
Short man, large dream.

1195
00:59:56,497 --> 01:00:00,027
"I send my rockets forth between my ears.

1196
01:00:00,027 --> 01:00:03,587
"Hoping an inch of good
is worth a pound of years.

1197
01:00:03,587 --> 01:00:07,867
"Aching to hear a voice cried
back along the universal mile.

1198
01:00:07,867 --> 01:00:10,467
"We've reached Alpha Centauri!

1199
01:00:10,467 --> 01:00:11,527
"We're tall,

1200
01:00:11,527 --> 01:00:14,049
"Oh God, we're tall."

1201
01:00:14,049 --> 01:00:16,966
(audience applaud)

1202
01:00:22,910 --> 01:00:25,540
- [Narrator] Mariner 9

became the first spacecraft

1203
01:00:25,540 --> 01:00:27,303
ever to orbit another planet.

1204
01:00:29,337 --> 01:00:32,140
(soft music)

1205
01:00:32,140 --> 01:00:34,910
Following right behind were
the two Soviet orbiters

1206
01:00:34,910 --> 01:00:37,000
with their landers aboard.

1207
01:00:37,000 --> 01:00:38,860
The landers designed to be released

1208
01:00:38,860 --> 01:00:40,490
just before orbit insertion

1209
01:00:40,490 --> 01:00:42,940
could not wait for better weather.

1210
01:00:42,940 --> 01:00:45,870
They would be plunging
into the Martian atmosphere

1211
01:00:45,870 --> 01:00:48,288
in the midst of the largest
dust storm ever known

1212
01:00:48,288 --> 01:00:50,843
to have occurred in the solar system.

1213
01:00:51,840 --> 01:00:53,300
- And for them it's much more serious

1214

01:00:53,300 --> 01:00:55,830
than losing a few mapping pictures,

1215
01:00:55,830 --> 01:00:58,120
because they have to come in

1216
01:00:58,120 --> 01:01:01,160
with wind velocities of many
hundreds of miles an hour

1217
01:01:01,160 --> 01:01:04,290
on something which has
some aerodynamic braking

1218
01:01:04,290 --> 01:01:06,930
or a parachute system.

1219
01:01:06,930 --> 01:01:09,190
And they have only a
certain acceptance cone

1220
01:01:09,190 --> 01:01:11,620
that their communications can get back.

1221
01:01:11,620 --> 01:01:14,130
Knowing that the Earth is
up there in the Martian sky,

1222
01:01:14,130 --> 01:01:15,530
spacecraft is falling in,

1223
01:01:15,530 --> 01:01:17,210
if you have strong winds,

1224
01:01:17,210 --> 01:01:20,010
the thing is swinging like
some pendulum and tilting over

1225
01:01:20,010 --> 01:01:24,460

then they potentially could
have very serious problems.

1226
01:01:24,460 --> 01:01:27,713
- [Narrator] Carl Sagan proved
correct about his concerns.

1227
01:01:30,800 --> 01:01:33,640
Whether caused by the Martian
winds or something else.

1228
01:01:33,640 --> 01:01:36,170
The first Soviet lander crashed onto Mars

1229
01:01:36,170 --> 01:01:38,513
after its parachute failed to open.

1230
01:01:39,970 --> 01:01:42,637
(ominous music)

1231
01:01:43,890 --> 01:01:46,593
The second descent module
succeeded in landing,

1232
01:01:47,950 --> 01:01:50,270
but less than 20 seconds after touchdown,

1233
01:01:50,270 --> 01:01:54,040
the lander went silent and
was not heard from again.

1234
01:01:54,040 --> 01:01:56,570
The tiny rover on board never had a chance

1235
01:01:56,570 --> 01:01:58,183
to move even an inch.

1236
01:02:00,000 --> 01:02:03,650
But the Lander did manage

to transmit 79 scan lines

1237
01:02:03,650 --> 01:02:04,483
of video.

1238
01:02:05,580 --> 01:02:07,790
Some consider this the first image,

1239
01:02:07,790 --> 01:02:11,113
however incomplete, from
the surface of Mars.

1240
01:02:16,698 --> 01:02:18,120
(martial music)

1241
01:02:18,120 --> 01:02:21,510
Though the landers failed,
the Soviet Union did succeed

1242
01:02:21,510 --> 01:02:24,132
in putting two spacecraft into orbit.

1243
01:02:24,132 --> 01:02:26,160
(rocket engine roars)

1244
01:02:26,160 --> 01:02:28,643
The space race was far from over.

1245
01:02:35,124 --> 01:02:37,791
(ominous music)

1246
01:02:38,640 --> 01:02:42,093
Eventually the dust storm
that had draped Mars subsided.

1247
01:02:43,130 --> 01:02:46,670
What the planet was finally
ready to reveal to Mariner 9

1248
01:02:46,670 --> 01:02:48,553
was more than worth the wait.

1249
01:02:49,470 --> 01:02:52,260
- It was a kind of epiphany

1250
01:02:52,260 --> 01:02:54,160
in the sense of what an orbiter can do

1251
01:02:54,160 --> 01:02:55,413
versus a flyby.

1252
01:02:56,280 --> 01:02:59,413
The previous two flybys,
Mariner 4 and Mariner 6 and 7,

1253
01:03:00,890 --> 01:03:02,610
all three of them had flown by

1254
01:03:02,610 --> 01:03:04,610
and it was just coincidentally

1255
01:03:04,610 --> 01:03:07,100
they'd all flown by the same side of Mars.

1256
01:03:07,100 --> 01:03:09,700
They'd flown by the
uninteresting side of Mars.

1257
01:03:11,370 --> 01:03:13,023
- And when the dust cleared

1258
01:03:13,910 --> 01:03:16,620
we found a planet that was
completely unlike the one

1259
01:03:16,620 --> 01:03:18,400
that Mariner 4 had seen,

1260
01:03:18,400 --> 01:03:20,773
and that Mariner 6 and 7, completely.

1261
01:03:21,985 --> 01:03:26,920
And so this planet, which we
had labeled "is like the Moon"

1262
01:03:26,920 --> 01:03:29,640
suddenly looked like
Earth, except the gigantic

1263
01:03:29,640 --> 01:03:33,320
bigger volcanoes, bigger flood channels,

1264
01:03:33,320 --> 01:03:36,530
a canyon that runs the distance
of the United States across

1265
01:03:36,530 --> 01:03:41,530
and is 60 miles wide in
places and six miles deep.

1266
01:03:42,540 --> 01:03:44,020
The grand Canyon of Arizona

1267
01:03:44,020 --> 01:03:46,470
would fit into one little
tributary off the side.

1268
01:03:47,620 --> 01:03:51,070
So we got really zapped because
not only was it Earth-like,

1269
01:03:51,070 --> 01:03:53,440
but everything was larger than here.

1270
01:03:53,440 --> 01:03:55,970
So that left us bewildered geologically.

1271
01:03:55,970 --> 01:03:59,880
But people who were interested
in life on Mars were ecstatic

1272
01:03:59,880 --> 01:04:01,950
because clearly there
had been an aqueous phase

1273
01:04:01,950 --> 01:04:03,200
in this planet's history.

1274
01:04:04,360 --> 01:04:06,490
- [Narrator] Mars had
yet again revealed itself

1275
01:04:06,490 --> 01:04:08,360
in a very different way.

1276
01:04:08,360 --> 01:04:12,010
It was now known to be a
geologically dynamic planet,

1277
01:04:12,010 --> 01:04:14,860
forcing Murray to reconsider
whether life on Mars

1278
01:04:14,860 --> 01:04:16,343
might still be possible.

1279
01:04:17,790 --> 01:04:20,690
- The consequence of
discovering these huge channels

1280
01:04:20,690 --> 01:04:25,610
in this larger than life
Earth-like planet out there

1281
01:04:25,610 --> 01:04:28,651

was to renew hopes that
there really is life there

1282
01:04:28,651 --> 01:04:31,870
and that the original dream
going back to telescope days

1283
01:04:31,870 --> 01:04:32,863
could be realized.

1284
01:04:34,220 --> 01:04:37,770
- [Narrator] Now there was
yet a new reason to go back.

1285
01:04:37,770 --> 01:04:42,770
Not to fly by or orbit, but
to land and search for life.

1286
01:04:48,055 --> 01:04:50,722
(ominous music)

1287
01:04:57,110 --> 01:04:59,660
The first challenge in
planetary exploration

1288
01:04:59,660 --> 01:05:01,343
was to fly by a planet.

1289
01:05:04,500 --> 01:05:06,213
The second was to go into orbit.

1290
01:05:10,840 --> 01:05:12,330
And still to this day

1291
01:05:12,330 --> 01:05:14,523
there is nothing harder than the third,

1292
01:05:16,140 --> 01:05:16,973
landing.

1293
01:05:18,850 --> 01:05:20,380
Touching the surface of Mars

1294
01:05:20,380 --> 01:05:23,770
was now the next great
engineering ambition,

1295
01:05:23,770 --> 01:05:26,913
which was more than matched
by a dramatic science goal.

1296
01:05:28,370 --> 01:05:30,833
To search for evidence of Martian life.

1297
01:05:32,511 --> 01:05:33,840
(ominous music)

1298
01:05:33,840 --> 01:05:36,310
To the consternation of JPL

1299
01:05:36,310 --> 01:05:39,313
it was not chosen to
lead this prized mission.

1300
01:05:41,120 --> 01:05:42,980
The reasons were many.

1301
01:05:42,980 --> 01:05:47,156
Relations between NASA and
JPL were often strained.

1302
01:05:47,156 --> 01:05:50,160
And the agency believed
the lab had its hands full

1303
01:05:50,160 --> 01:05:51,823
with other assignments.

1304
01:05:54,350 --> 01:05:57,010
NASA also wanted to
spread the wealth of work

1305
01:05:57,010 --> 01:05:58,840
to its Centers.

1306
01:05:58,840 --> 01:06:01,260
Besides, the Langley
Research Center in Virginia

1307
01:06:01,260 --> 01:06:03,720
had an impressive record
in sending spacecraft

1308
01:06:03,720 --> 01:06:05,123
to reconnoiter the moon.

1309
01:06:06,540 --> 01:06:10,063
Key to Langley's success was
project manager Jim Martin.

1310
01:06:11,160 --> 01:06:13,993
He was known to be as
tough as he was successful.

1311
01:06:14,940 --> 01:06:17,790
He cared little of title or a rank.

1312
01:06:17,790 --> 01:06:20,163
What mattered was performance.

1313
01:06:22,090 --> 01:06:24,370
- He was 6'4", 6'5".

1314
01:06:24,370 --> 01:06:25,710
He looked like a commander.

1315

01:06:25,710 --> 01:06:28,420
He stood up strong with huge barrel chest.

1316
01:06:28,420 --> 01:06:30,330
He had a gray flat top.

1317
01:06:30,330 --> 01:06:32,990
His eyes were taking in
everything all the time

1318
01:06:32,990 --> 01:06:35,410
and you expected him almost to bark.

1319
01:06:35,410 --> 01:06:38,550
This is launch complex 41

1320
01:06:38,550 --> 01:06:40,980
from where the Viking
missions will be launched

1321
01:06:40,980 --> 01:06:42,930
on the Titan Centaur launch vehicle.

1322
01:06:42,930 --> 01:06:44,370
- The New York Times
had a big story on him,

1323
01:06:44,370 --> 01:06:47,660
right after Viking, which likened
him to a Prussian general.

1324
01:06:47,660 --> 01:06:49,720
And to people who did not know him,

1325
01:06:49,720 --> 01:06:51,900
who did not see his softness,

1326
01:06:51,900 --> 01:06:52,810
he was.

1327
01:06:52,810 --> 01:06:55,733
He did not suffer fools.

1328
01:06:58,390 --> 01:07:00,070
- [Narrator] With Martin in charge

1329
01:07:00,070 --> 01:07:03,410
Langley had overall responsibility
for managing the project

1330
01:07:03,410 --> 01:07:04,853
that was named Viking.

1331
01:07:06,570 --> 01:07:09,070
The aerospace corporation Martin Marietta

1332
01:07:09,070 --> 01:07:11,563
won the competition to
build the two landers.

1333
01:07:12,860 --> 01:07:15,910
Their arms were to reach down
and scoop up soil samples

1334
01:07:15,910 --> 01:07:19,573
to be examined in an onboard
lab for signs of life.

1335
01:07:23,540 --> 01:07:26,150
JPL's role was to build a spacecraft

1336
01:07:26,150 --> 01:07:28,400
that would ferry the landers to Mars,

1337
01:07:28,400 --> 01:07:31,010
relay information from them back to earth

1338

01:07:31,010 --> 01:07:33,980
and conduct orbital science.

1339
01:07:33,980 --> 01:07:37,820
Given the lab's expertise in
navigation and communications,

1340
01:07:37,820 --> 01:07:39,690
operations would also be conducted

1341
01:07:39,690 --> 01:07:42,003
out of JPL's mission control.

1342
01:07:43,290 --> 01:07:46,600
All told Martin's army
was a massive operation

1343
01:07:46,600 --> 01:07:48,210
spanning the nation.

1344
01:07:48,210 --> 01:07:51,810
Requiring eight years,
more than 10,000 people

1345
01:07:51,810 --> 01:07:53,580
and the largest budget yet then

1346
01:07:53,580 --> 01:07:55,913
spent on a planetary project.

1347
01:07:59,220 --> 01:08:01,590
- The team that actually flew the mission

1348
01:08:01,590 --> 01:08:03,440
was a badgeless team.

1349
01:08:03,440 --> 01:08:05,260
Our badges said Viking.

1350
01:08:05,260 --> 01:08:08,160
They did not say the Martin
Marietta Corporation,

1351
01:08:08,160 --> 01:08:09,580
NASA Langley,

1352
01:08:09,580 --> 01:08:11,260
the Jet Propulsion Laboratory

1353
01:08:11,260 --> 01:08:13,410
or any of the many subcontractors.

1354
01:08:13,410 --> 01:08:18,143
There was an allegiance
throughout the team to Viking.

1355
01:08:19,100 --> 01:08:22,060
- [Narrator] Martin took a
special liking to Gentry Lee,

1356
01:08:22,060 --> 01:08:23,860
a young Martin Marietta engineer,

1357
01:08:23,860 --> 01:08:26,660
whose style of dress and length of hair

1358
01:08:26,660 --> 01:08:29,740
ran counter to the
culture of his employer.

1359
01:08:29,740 --> 01:08:32,630
- I was 28 years old.

1360
01:08:32,630 --> 01:08:35,940
My hair was down below my shoulders

1361
01:08:35,940 --> 01:08:38,490

and had little curls at the bottom of it.

1362
01:08:38,490 --> 01:08:41,690
I wore white jeans with strawberries

1363
01:08:41,690 --> 01:08:43,390
scattered all over them.

1364
01:08:43,390 --> 01:08:46,180
And I once went to one
of these monthly reviews

1365
01:08:46,180 --> 01:08:48,040
wearing a pink shirt.

1366
01:08:48,040 --> 01:08:51,950
And the chairman of the
Martin Marietta Corporation

1367
01:08:51,950 --> 01:08:54,980
at that time happened to
attend that particular meeting

1368
01:08:54,980 --> 01:08:58,280
and he asked Jim Martin

1369
01:08:58,280 --> 01:09:02,910
"Who is the kid in the pink
shirt and the strawberry jeans?"

1370
01:09:02,910 --> 01:09:04,900
And Jim Martin looked at him and said,

1371
01:09:04,900 --> 01:09:06,173
"Well, he's one of yours."

1372
01:09:07,330 --> 01:09:09,843
Gentry Lee is a different individual.

1373
01:09:10,730 --> 01:09:13,750
One of his big bosses told
him his hair was too long

1374
01:09:13,750 --> 01:09:16,320
and he'd never get any
place with long hair.

1375
01:09:16,320 --> 01:09:19,400
Gentry was a guy that
could decide for himself

1376
01:09:19,400 --> 01:09:21,767
how long his hair wanted to be.

1377
01:09:21,767 --> 01:09:25,683
So as a result he went to work for JPL.

1378
01:09:26,910 --> 01:09:28,580
He's probably one of the brightest people

1379
01:09:28,580 --> 01:09:30,060
I ever encountered.

1380
01:09:30,060 --> 01:09:31,397
- Well, what we actually have to do

1381
01:09:31,397 --> 01:09:33,570
is becoming clearer as
we learn more about Mars,

1382
01:09:33,570 --> 01:09:35,620
is press all the way back
to the beginning of time

1383
01:09:35,620 --> 01:09:37,430
and go through the geological evolution,

1384

01:09:37,430 --> 01:09:38,560
the atmospheric evolution,

1385
01:09:38,560 --> 01:09:40,010
the interaction of the two,

1386
01:09:40,010 --> 01:09:42,040
and somewhere different
kinds of molecules form.

1387
01:09:42,040 --> 01:09:44,410
And somewhere they may
become life and so forth.

1388
01:09:44,410 --> 01:09:46,270
So that's the sort of thing in general

1389
01:09:46,270 --> 01:09:48,480
that I had hoped we would talk about-

1390
01:09:48,480 --> 01:09:50,420
- And I hope you'll be glad to know

1391
01:09:50,420 --> 01:09:53,040
that for this complete survey
of all of human knowledge,

1392
01:09:53,040 --> 01:09:54,883
considering all of it,

1393
01:09:54,883 --> 01:09:56,390
we have allowed you half an hour.

1394
01:09:56,390 --> 01:09:57,223
- Okay.

1395
01:09:57,223 --> 01:09:59,780
- [Narrator] Martin made Lee
a key player in the mission,

1396
01:09:59,780 --> 01:10:02,650
assigning him the role of
coordinating science analysis

1397
01:10:02,650 --> 01:10:04,247
and mission planning.

1398
01:10:04,247 --> 01:10:07,630
That meant leading the
science team to consensus.

1399
01:10:07,630 --> 01:10:10,570
It was like herding cats, one person said.

1400
01:10:10,570 --> 01:10:14,270
Very smart but very independent cats.

1401
01:10:14,270 --> 01:10:16,400
- I had all the scientists
and all the mission analysts

1402
01:10:16,400 --> 01:10:18,150
under me, and as I often tell people,

1403
01:10:18,150 --> 01:10:20,690
I had two Nobel prize winners
and four who took me aside

1404
01:10:20,690 --> 01:10:23,560
and explained why they should
have won the Nobel prize.

1405
01:10:23,560 --> 01:10:24,393
It was quite a group.

1406
01:10:24,393 --> 01:10:25,690
It was quite an adventure.

1407
01:10:26,830 --> 01:10:29,270
- [Narrator] There were
other jobs Martin gave Lee,

1408
01:10:29,270 --> 01:10:32,070
including running political interference.

1409
01:10:32,070 --> 01:10:35,040
One assignment was explaining
to a White House official,

1410
01:10:35,040 --> 01:10:37,009
oblivious to planetary alignments,

1411
01:10:37,009 --> 01:10:40,610
why delaying a launch to
Mars required two years

1412
01:10:40,610 --> 01:10:41,833
rather than one.

1413
01:10:43,030 --> 01:10:45,600
- I get this guy who announces
he's some big muckamuck

1414
01:10:45,600 --> 01:10:46,740
in the White House

1415
01:10:46,740 --> 01:10:49,100
and he's clearly irritated.

1416
01:10:49,100 --> 01:10:52,250
He says, "If I want to
take a bus to Alexandria

1417
01:10:52,250 --> 01:10:54,890
and I want to delay for a
year, I delay for a year.

1418
01:10:54,890 --> 01:10:57,810
So why can't you go to
Mars one year later?"

1419
01:10:57,810 --> 01:11:01,020
And I said, "Well, it's the
way the planets are set up.

1420
01:11:01,020 --> 01:11:02,910
"And I don't think the president

1421
01:11:02,910 --> 01:11:05,110
"has the power to change that."

1422
01:11:05,110 --> 01:11:07,247
There was quiet on the
other end of the phone,

1423
01:11:07,247 --> 01:11:10,053
and he says, "Are you a smart ass?"

1424
01:11:10,053 --> 01:11:12,600
(rocket engine fires up)

1425
01:11:12,600 --> 01:11:14,100
- [Narrator] In 1975

1426
01:11:14,100 --> 01:11:16,483
the two Vikings lifted off the launch pad.

1427
01:11:19,370 --> 01:11:22,060
And just as the laws of physics dictated,

1428
01:11:22,060 --> 01:11:24,423
10 months later they were nearing Mars.

1429
01:11:25,430 --> 01:11:27,740
And having learned from

the Soviet misfortunes

1430
01:11:27,740 --> 01:11:29,210
with the dust storm

1431
01:11:29,210 --> 01:11:31,440
the Viking landers were
designed to be released

1432
01:11:31,440 --> 01:11:33,450
at the time of the mission's choosing

1433
01:11:33,450 --> 01:11:36,000
after going into orbit.

1434
01:11:36,000 --> 01:11:40,181
- Viking, very cleverly, is
to carry the lander into orbit

1435
01:11:40,181 --> 01:11:44,263
and not have to drop it for a
period of more than a month.

1436
01:11:45,139 --> 01:11:48,723
Viking will be able to pick
its places very nicely.

1437
01:11:50,390 --> 01:11:52,410
- [Narrator] Being able
to choose not only where

1438
01:11:52,410 --> 01:11:54,070
but when to land

1439
01:11:54,070 --> 01:11:57,460
offered a huge public
relations opportunity.

1440
01:11:57,460 --> 01:12:01,450

The 4th of July in 1976 would
be the 200th anniversary

1441
01:12:01,450 --> 01:12:03,363
of the Declaration of Independence.

1442
01:12:04,320 --> 01:12:05,153
What could be better

1443
01:12:05,153 --> 01:12:07,370
than to celebrate America's bicentennial

1444
01:12:07,370 --> 01:12:08,963
than landing on Mars?

1445
01:12:10,950 --> 01:12:12,593
That was the expectation.

1446
01:12:14,519 --> 01:12:16,540
(soft music)

1447
01:12:16,540 --> 01:12:19,560
And as scheduled, Viking 1 went into orbit

1448
01:12:19,560 --> 01:12:23,640
and began sending back images
of the proposed landing site.

1449
01:12:23,640 --> 01:12:26,343
What the pictures revealed was a shock.

1450
01:12:27,200 --> 01:12:28,320
- We got into orbit around Mars.

1451
01:12:28,320 --> 01:12:30,860
Everybody celebrated. And
on the third periapsis

1452

01:12:30,860 --> 01:12:33,013
we took photographs of our landing site.

1453
01:12:34,400 --> 01:12:36,750
So the first time we spread
out these photographs,

1454
01:12:36,750 --> 01:12:39,220
we looked at where we had
thought we were going to land

1455
01:12:39,220 --> 01:12:40,053
a priori

1456
01:12:40,053 --> 01:12:41,536
and I remember Mike [Indistinct]

1457
01:12:41,536 --> 01:12:43,600
and Carl Sagan and Hal Mazurski

1458
01:12:43,600 --> 01:12:44,433
and Hugh Kieffer

1459
01:12:44,433 --> 01:12:46,950
and I just eagerly
sitting around the table

1460
01:12:46,950 --> 01:12:47,890
looking at the pictures.

1461
01:12:47,890 --> 01:12:49,220
And then I heard,

1462
01:12:49,220 --> 01:12:51,510
"Oh, oh! that looks like an
outflow of river channels.

1463
01:12:51,510 --> 01:12:53,260
"And there're gonna be boulders there."

1464
01:12:53,260 --> 01:12:55,760
And then Jim Martin strode up and said,

1465
01:12:55,760 --> 01:12:57,100
"And what does it look like?"

1466
01:12:57,100 --> 01:12:58,530
I said, "It looks bad."

1467
01:12:58,530 --> 01:13:01,210
"It looks bad?" He turned to me, he said,

1468
01:13:01,210 --> 01:13:05,120
"Plans A and B go into
effect immediately."

1469
01:13:05,120 --> 01:13:10,120
That began 18 days of
what's the next option?

1470
01:13:10,520 --> 01:13:11,730
What's the next option?

1471
01:13:11,730 --> 01:13:13,050
That's not a good place to land.

1472
01:13:13,050 --> 01:13:13,910
Where do we go now?

1473
01:13:13,910 --> 01:13:16,059
What photographs are we
going to take tomorrow?

1474
01:13:16,059 --> 01:13:19,380
And finally, with that
second Viking coming in,

1475

01:13:19,380 --> 01:13:22,380
we were getting to the point
where our nerves were strained.

1476
01:13:23,270 --> 01:13:25,260
The hardest job of all this though,

1477
01:13:25,260 --> 01:13:27,180
was the job of telling President Ford,

1478
01:13:27,180 --> 01:13:29,540
that we were not going
to land on July the 4th.

1479
01:13:29,540 --> 01:13:32,290
So I looked at Jim and
I said, "Well, Jim..."

1480
01:13:32,290 --> 01:13:33,850
He said, "I got it."

1481
01:13:33,850 --> 01:13:35,940
First of course, he had to
call the NASA Administrator

1482
01:13:35,940 --> 01:13:37,650
who tried to talk him out of it.

1483
01:13:37,650 --> 01:13:40,550
And Jim said, "Well, I'm going
to tell you something, sir.

1484
01:13:40,550 --> 01:13:43,550
"If we land there, I'm not responsible."

1485
01:13:43,550 --> 01:13:45,161
It was quiet on the
other end of the phone.

1486

01:13:45,161 --> 01:13:45,994
Then he says,

1487
01:13:45,994 --> 01:13:46,827
"I'll call the president."

1488
01:13:48,158 --> 01:13:51,330
- I am disappointed as are many people.

1489
01:13:51,330 --> 01:13:55,040
But yet we've always had
in the back of our mind

1490
01:13:55,040 --> 01:13:57,540
the fact that Mars might not cooperate.

1491
01:13:57,540 --> 01:14:00,120
And I guess I would say it has not.

1492
01:14:00,120 --> 01:14:01,760
- [Narrator] It was not the only time

1493
01:14:01,760 --> 01:14:03,903
that Martin would disappoint Washington.

1494
01:14:05,273 --> 01:14:07,423
- An hour before the landing

1495
01:14:08,750 --> 01:14:12,100
I received a phone call
from the White House.

1496
01:14:12,100 --> 01:14:14,990
- We were in the middle
of the lander checkout,

1497
01:14:14,990 --> 01:14:18,700
prior to separating the
lander from the orbiter

1498
01:14:18,700 --> 01:14:21,780
and then prior to, of course,
to the lander's descending

1499
01:14:21,780 --> 01:14:23,513
and subsequent landing.

1500
01:14:24,380 --> 01:14:25,860
Jim was in his office,

1501
01:14:25,860 --> 01:14:27,620
which was kind of a glass cage

1502
01:14:27,620 --> 01:14:30,330
in the middle of the
flight operations area.

1503
01:14:30,330 --> 01:14:33,400
The voice on the other end of
the line says, "Mr. Martin?"

1504
01:14:33,400 --> 01:14:34,370
"Yes."

1505
01:14:34,370 --> 01:14:36,210
"Mr. Martin, this is the
White House calling."

1506
01:14:36,210 --> 01:14:38,200
"You tell President Ford, please,

1507
01:14:38,200 --> 01:14:40,480
"that I do not have any time
to speak to him right now.

1508
01:14:40,480 --> 01:14:42,380
"We're in the middle of a lander checkout.

1509
01:14:42,380 --> 01:14:44,723
"And for him to call back in three hours."

1510
01:14:46,000 --> 01:14:49,490
- The Administrator was sitting
in my office at the time.

1511
01:14:49,490 --> 01:14:52,710
He said, "Did you tell the
White House you were too busy

1512
01:14:52,710 --> 01:14:53,970
"to talk to them?"

1513
01:14:53,970 --> 01:14:54,820
And I said, "yes,

1514
01:14:54,820 --> 01:14:56,080
"because I am too busy.

1515
01:14:56,080 --> 01:14:58,400
"Right now is absolutely the wrong time.

1516
01:14:58,400 --> 01:15:00,043
"Look at everything that's going on."

1517
01:15:01,010 --> 01:15:03,790
He said, "Well, I understand,
but that's the White House."

1518
01:15:03,790 --> 01:15:07,580
I said, "I'm sorry. This job
of getting the mission down

1519
01:15:07,580 --> 01:15:11,690
on the surface is the most
important thing in my mind."

1520

01:15:11,690 --> 01:15:13,030
- In three hours,

1521
01:15:13,030 --> 01:15:15,270
President Ford called back.

1522
01:15:15,270 --> 01:15:17,130
Now, for those of us who'd worked for Jim

1523
01:15:17,130 --> 01:15:19,270
for eight plus years,

1524
01:15:19,270 --> 01:15:20,450
it was a no brainer.

1525
01:15:20,450 --> 01:15:22,480
Of course the President
was going to call him back.

1526
01:15:22,480 --> 01:15:23,623
Jim told him to.

1527
01:15:33,160 --> 01:15:37,180
- [Narrator] In the early
morning hours of July 20th, 1976

1528
01:15:37,180 --> 01:15:40,200
the Viking 1 lander
separated from the orbiter

1529
01:15:40,200 --> 01:15:42,963
and began the descent
to the Martian surface.

1530
01:15:47,707 --> 01:15:51,290
(indistinct radio chatter)

1531
01:15:58,480 --> 01:15:59,313
- You have to realize this was

1532
01:15:59,313 --> 01:16:02,050
before anybody knew
about onboard software,

1533
01:16:02,050 --> 01:16:03,340
closed loop guidance.

1534
01:16:03,340 --> 01:16:04,653
It had to do a parachute.

1535
01:16:05,956 --> 01:16:08,556
- [Control voice] [indistinct]
The chute has been deployed.

1536
01:16:10,434 --> 01:16:11,630
- Then it had to do a terminal descent,

1537
01:16:11,630 --> 01:16:15,110
where its radar, its four
beam radar, and land softly.

1538
01:16:15,110 --> 01:16:17,440
It had to go from 10,000 miles an hour

1539
01:16:17,440 --> 01:16:19,050
to between two and three miles per hour

1540
01:16:19,050 --> 01:16:22,373
in just a few minutes, and it
had never been done before.

1541
01:16:22,373 --> 01:16:24,488
(indistinct crosstalk)

1542
01:16:24,488 --> 01:16:25,341
- 2600?

1543

01:16:25,341 --> 01:16:28,591
- 100 feet, 40 feet per second.

1544
01:16:31,820 --> 01:16:33,433
76 feet, 73 feet per second.

1545
01:16:34,380 --> 01:16:36,280
- [Engineer] ACS is close to vertical.

1546
01:16:37,437 --> 01:16:39,540
- [Engineer] Now we're
coming down, straight down.

1547
01:16:39,540 --> 01:16:41,120
- [Engineer] Now just green for touchdown.

1548
01:16:41,120 --> 01:16:43,473
- [Engineer] ACS green
1.5 degrees per second.

1549
01:16:45,840 --> 01:16:46,827
- Touch down.

1550
01:16:46,827 --> 01:16:49,059
We have a touchdown.
(group cheers)

1551
01:16:49,059 --> 01:16:51,309
(applause)

1552
01:16:58,550 --> 01:16:59,940
- We knew it had sent the message

1553
01:16:59,940 --> 01:17:01,830
and survived at least momentarily.

1554
01:17:01,830 --> 01:17:04,010
But then we had to wait 40 minutes

1555
01:17:04,010 --> 01:17:06,910
for the orbiter to play...
to turn to the Earth

1556
01:17:06,910 --> 01:17:09,525
and play the lander data back.

1557
01:17:09,525 --> 01:17:11,830
- And there is the first piece
of [indistinct] coming in.

1558
01:17:11,830 --> 01:17:14,400
- A moment in every Viking's life

1559
01:17:14,400 --> 01:17:16,260
that he or she will never forget

1560
01:17:16,260 --> 01:17:19,670
is sitting with that television
right in front of them

1561
01:17:19,670 --> 01:17:21,883
And watching as the first lines came down.

1562
01:17:21,883 --> 01:17:25,853
They came down line by
line by line by line.

1563
01:17:28,900 --> 01:17:30,050
- [Engineer] See rocks.

1564
01:17:32,120 --> 01:17:33,430
- [Engineer] That's beautiful.

1565
01:17:33,430 --> 01:17:37,920
- The first photograph that
a human being has ever seen

1566

01:17:37,920 --> 01:17:40,930
from the surface of another planet.

1567
01:17:40,930 --> 01:17:43,003
- [Jim] Yeah, I'm supposed to
say something at this point.

1568
01:17:43,003 --> 01:17:45,724
I just don't feel like talking.

1569
01:17:45,724 --> 01:17:50,724
It's just incredible to see
that Mars is really there.

1570
01:17:52,230 --> 01:17:56,680
- And we all, 5 billion
people on the planet Earth,

1571
01:17:56,680 --> 01:17:59,033
saw Mars for the very first time.

1572
01:18:00,660 --> 01:18:02,160
- Look at that beautiful rock.

1573
01:18:04,950 --> 01:18:07,570
And all of a sudden we were
looking at the surface of Mars

1574
01:18:07,570 --> 01:18:10,408
and it was clear, it wasn't dusty.

1575
01:18:10,408 --> 01:18:13,350
And when we got to the
end of that first picture

1576
01:18:13,350 --> 01:18:17,870
with the dust and the small
pebbles in the footpad,

1577

01:18:22,121 --> 01:18:23,783
it was just a... it was really a miracle.

1578
01:18:25,490 --> 01:18:27,880
- [Narrator] Images that came
down in the following days

1579
01:18:27,880 --> 01:18:30,873
revealed that the mission
had been as lucky as skilled.

1580
01:18:32,120 --> 01:18:35,053
There were rocks and boulders everywhere.

1581
01:18:36,650 --> 01:18:40,000
- Can you see this big rock
out there called Big Joe?

1582
01:18:40,000 --> 01:18:43,050
That was about 25 or 30
feet from the lander.

1583
01:18:43,050 --> 01:18:47,120
If we had hit that rock, the
lander would have been smashed.

1584
01:18:47,120 --> 01:18:50,950
The lander found its way to the surface

1585
01:18:50,950 --> 01:18:54,830
in a very smooth spot
and avoided the rocks.

1586
01:18:54,830 --> 01:18:57,370
We had no hazard avoidance whatsoever.

1587
01:18:57,370 --> 01:18:59,803
Just a lot of luck, if you will.

1588

01:19:03,130 --> 01:19:06,460
- It never occurred to me
that we really might fail.

1589
01:19:06,460 --> 01:19:08,400
I got those butterflies in my stomach,

1590
01:19:08,400 --> 01:19:12,420
but we didn't know then what we know now,

1591
01:19:12,420 --> 01:19:15,420
which is how tough it
really is to land on Mars.

1592
01:19:15,420 --> 01:19:17,410
And the other thing we didn't know

1593
01:19:17,410 --> 01:19:19,820
is that we were surrounded by the best

1594
01:19:19,820 --> 01:19:23,420
and brightest engineers
you could possibly find.

1595
01:19:23,420 --> 01:19:25,680
The best and brightest
from Martin Marietta,

1596
01:19:25,680 --> 01:19:27,650
the prime contractor who built the lander,

1597
01:19:27,650 --> 01:19:30,380
the best and brightest from
the Jet Propulsion Laboratory

1598
01:19:30,380 --> 01:19:31,450
who built the orbiters.

1599
01:19:31,450 --> 01:19:34,610

The best and brightest
NASA had at NASA Langley

1600
01:19:34,610 --> 01:19:37,070
and other places, they ran the mission,

1601
01:19:37,070 --> 01:19:40,256
but mostly we had become a team.

1602
01:19:40,256 --> 01:19:45,256
Jim Martin skillful over
five, six years of time

1603
01:19:46,070 --> 01:19:49,510
picked the very best he
could find in every spot.

1604
01:19:49,510 --> 01:19:51,810
And so later on in life, we
would look at each other.

1605
01:19:51,810 --> 01:19:55,430
We say, "My gosh, weren't the
people on that project smart?"

1606
01:19:55,430 --> 01:19:58,371
And we didn't realize this had
all been orchestrated for us.

1607
01:19:58,371 --> 01:20:01,038
(ominous music)

1608
01:20:08,360 --> 01:20:10,510
- [Narrator] Now safely
on the Martian surface

1609
01:20:10,510 --> 01:20:13,123
there was time for a call from Washington.

1610

01:20:14,540 --> 01:20:15,570
- Hello, Mr. President.

1611
01:20:15,570 --> 01:20:17,510
Jim Martin and myself are on the line.

1612
01:20:17,510 --> 01:20:20,440
- [President] Nice to
talk to you Jim Martin.

1613
01:20:20,440 --> 01:20:21,540
- [Jim] Thank you sir.
- Let me congratulate

1614
01:20:21,540 --> 01:20:22,730
Dr. Jim Fletcher,

1615
01:20:22,730 --> 01:20:25,880
the Administrator of NASA, and you,

1616
01:20:25,880 --> 01:20:29,460
the Viking Project Coordinator,

1617
01:20:29,460 --> 01:20:33,630
for the just wonderful and
most remarkable success

1618
01:20:33,630 --> 01:20:35,103
in this historic mission.

1619
01:20:35,970 --> 01:20:39,100
And I strongly encourage all Americans

1620
01:20:39,100 --> 01:20:41,550
to follow the progress
of our Viking missions

1621
01:20:41,550 --> 01:20:46,283
and to reflect on our

journey into the unknown.

1622
01:20:47,500 --> 01:20:52,500
Do we have any plans for
a Viking 3, et cetera?

1623
01:20:53,270 --> 01:20:55,040
- Mr. President, we're thinking very hard

1624
01:20:55,040 --> 01:20:56,860
about that right now.

1625
01:20:56,860 --> 01:20:58,730
I just got a big bunch of applause

1626
01:20:58,730 --> 01:21:00,410
from our team here on that question.

1627
01:21:00,410 --> 01:21:03,670
- [President] Well, I suspected
that there might be approval

1628
01:21:03,670 --> 01:21:05,680
among all of you for such a landing

1629
01:21:05,680 --> 01:21:07,518
and such a project and-

1630
01:21:07,518 --> 01:21:12,423
- Mr. President, the team is
ready for Vikings 3,4,5 and 6.

1631
01:21:13,960 --> 01:21:16,970
- [President] Well, give
everybody my very best will you?

1632
01:21:16,970 --> 01:21:20,780
And let me express to each
of you and all of the group

1633
01:21:20,780 --> 01:21:23,700
my very best wishes for a great job.

1634
01:21:23,700 --> 01:21:25,610
We're all very proud of you.

1635
01:21:25,610 --> 01:21:27,510
- [James] I appreciate those
kind words, Mr. President.

1636
01:21:27,510 --> 01:21:29,460
- Thank you, Mr. President.

1637
01:21:29,460 --> 01:21:30,293
- [President] Good bye.

1638
01:21:30,293 --> 01:21:31,126
- Thank you.

1639
01:21:33,277 --> 01:21:36,027
(group applauds)

1640
01:21:37,500 --> 01:21:39,980
- [Narrator] The enthusiasm
for more Martian missions

1641
01:21:39,980 --> 01:21:42,266
proved wishful thinking.

1642
01:21:42,266 --> 01:21:43,800
(ominous music)

1643
01:21:43,800 --> 01:21:45,530
Although Martin's team had achieved

1644
01:21:45,530 --> 01:21:48,310
an enormous engineering feat

in the successful landings

1645
01:21:48,310 --> 01:21:50,089
of both Vikings,

1646
01:21:50,089 --> 01:21:52,450
the primary science mission,

1647
01:21:52,450 --> 01:21:55,990
the search for life,
was inconclusive at best

1648
01:21:55,990 --> 01:21:57,653
and discouraging for many.

1649
01:21:59,560 --> 01:22:00,660
- Not just that there was no life,

1650
01:22:00,660 --> 01:22:02,040
but there was no organic material.

1651
01:22:02,040 --> 01:22:04,380
And they found out the explanation

1652
01:22:04,380 --> 01:22:05,650
was that Mars is self-sterilized.

1653
01:22:05,650 --> 01:22:06,550
Nobody expected that.

1654
01:22:06,550 --> 01:22:07,533
I didn't. No one.

1655
01:22:09,297 --> 01:22:10,510
(ominous music)

1656
01:22:10,510 --> 01:22:12,120
- [Narrator] But circling over the landers

1657
01:22:12,120 --> 01:22:13,853
were the Viking orbiters.

1658
01:22:16,420 --> 01:22:20,240
They provided six years of
continuous monitoring of Mars

1659
01:22:20,240 --> 01:22:23,233
and once again changed our
understanding of the planet.

1660
01:22:26,380 --> 01:22:28,890
Here was a planet not only of craters,

1661
01:22:28,890 --> 01:22:32,220
vast trenches and giant volcanoes,

1662
01:22:32,220 --> 01:22:35,030
but also what appeared
to be great river valleys

1663
01:22:35,030 --> 01:22:37,463
carved out by massive amounts of water.

1664
01:22:38,450 --> 01:22:40,180
At some point in the past

1665
01:22:40,180 --> 01:22:42,823
the surface must have
been warmer and wetter.

1666
01:22:44,010 --> 01:22:45,883
If so, what had happened?

1667
01:22:48,130 --> 01:22:50,633
Mars was more mysterious than ever.

1668

01:22:51,811 --> 01:22:53,380
(ominous music)

1669
01:22:53,380 --> 01:22:54,950
But to the dismay of many

1670
01:22:54,950 --> 01:22:57,863
interest in future
missions began to dwindle.

1671
01:22:58,760 --> 01:23:01,340
- I've talked to a large
number of the scientists

1672
01:23:01,340 --> 01:23:05,030
in this program who are
unhappy that, in their view,

1673
01:23:05,030 --> 01:23:07,680
the space agency has no
follow-on program for Viking

1674
01:23:07,680 --> 01:23:09,130
at this time.

1675
01:23:09,130 --> 01:23:10,513
Is it true? Why is it true?

1676
01:23:11,480 --> 01:23:15,210
- I think that that the planetary program

1677
01:23:15,210 --> 01:23:20,210
must get a new infusion of adrenaline

1678
01:23:21,440 --> 01:23:24,373
or it will die a death through neglect.

1679
01:23:27,120 --> 01:23:30,530
- [Narrator] JPL was worried

for the same reasons.

1680
01:23:30,530 --> 01:23:32,530
Having Viking operations conducted

1681
01:23:32,530 --> 01:23:34,620
out of the lab's mission control

1682
01:23:34,620 --> 01:23:37,170
had been a great windfall
of public attention

1683
01:23:37,170 --> 01:23:39,383
and at times misplaced credit.

1684
01:23:40,230 --> 01:23:42,333
But the outlook ahead seemed bleak.

1685
01:23:43,290 --> 01:23:45,780
NASA's budget was under severe pressure.

1686
01:23:45,780 --> 01:23:48,740
And the pipeline for
future planetary missions

1687
01:23:48,740 --> 01:23:51,210
was reduced to a trickle.

1688
01:23:51,210 --> 01:23:52,900
As for Mars

1689
01:23:52,900 --> 01:23:56,593
the United States would not
return there for two decades.

1690
01:24:02,390 --> 01:24:05,057
(ominous music)

1691

01:24:41,200 --> 01:24:43,140
- This is an example.

1692
01:24:43,140 --> 01:24:44,900
It's a bit of the Martian weather

1693
01:24:44,900 --> 01:24:47,008
that we've reproduced for you.

1694
01:24:52,110 --> 01:24:53,890
No, it isn't snow.

1695
01:24:53,890 --> 01:24:55,310
It's a different kind of weather

1696
01:24:55,310 --> 01:24:58,740
that scientists have predicted
that we may find on Mars.

1697
01:24:58,740 --> 01:25:00,290
This is the theory.

1698
01:25:00,290 --> 01:25:03,748
If the Martian atmosphere
contains carbon dioxide

1699
01:25:03,748 --> 01:25:05,520
and methane,

1700
01:25:05,520 --> 01:25:08,350
and they are exposed to
the ultraviolet radiation

1701
01:25:08,350 --> 01:25:11,730
of the sun, they may produce sugar.

1702
01:25:11,730 --> 01:25:15,760
In other words, there may be
a constant sugar fall on Mars.

1703
01:25:15,760 --> 01:25:18,320
We know that Mars is very dry.

1704
01:25:18,320 --> 01:25:21,310
Life forms on Mars may
have developed special ways

1705
01:25:21,310 --> 01:25:23,373
of preserving their water content.

1706
01:25:24,950 --> 01:25:27,100
There may be a kind of plant,

1707
01:25:27,100 --> 01:25:28,053
an ice-eater.

1708
01:25:29,460 --> 01:25:33,320
We know that water bearing
rocks can be found on Mars.

1709
01:25:33,320 --> 01:25:35,730
And creatures that
actually digest the rock

1710
01:25:35,730 --> 01:25:38,800
to extract water from it are possible.

1711
01:25:38,800 --> 01:25:40,700
- It's particularly important for me,

1712
01:25:40,700 --> 01:25:42,250
if I can throw a personal note in,

1713
01:25:42,250 --> 01:25:45,550
because right at the same
time we were landing on Mars,

1714

01:25:45,550 --> 01:25:47,210
right at the time we
were trying to discover

1715
01:25:47,210 --> 01:25:50,540
whether or not there is
life on another planet.

1716
01:25:50,540 --> 01:25:53,330
I am also going through
a personal experience,

1717
01:25:53,330 --> 01:25:54,590
which is considerably interesting.

1718
01:25:54,590 --> 01:25:56,300
I'm having my first child.

1719
01:25:56,300 --> 01:25:57,970
And the two together has caused me

1720
01:25:57,970 --> 01:26:00,070
to be in a state of wonder at life

1721
01:26:00,070 --> 01:26:01,880
and excitement about what's going on.