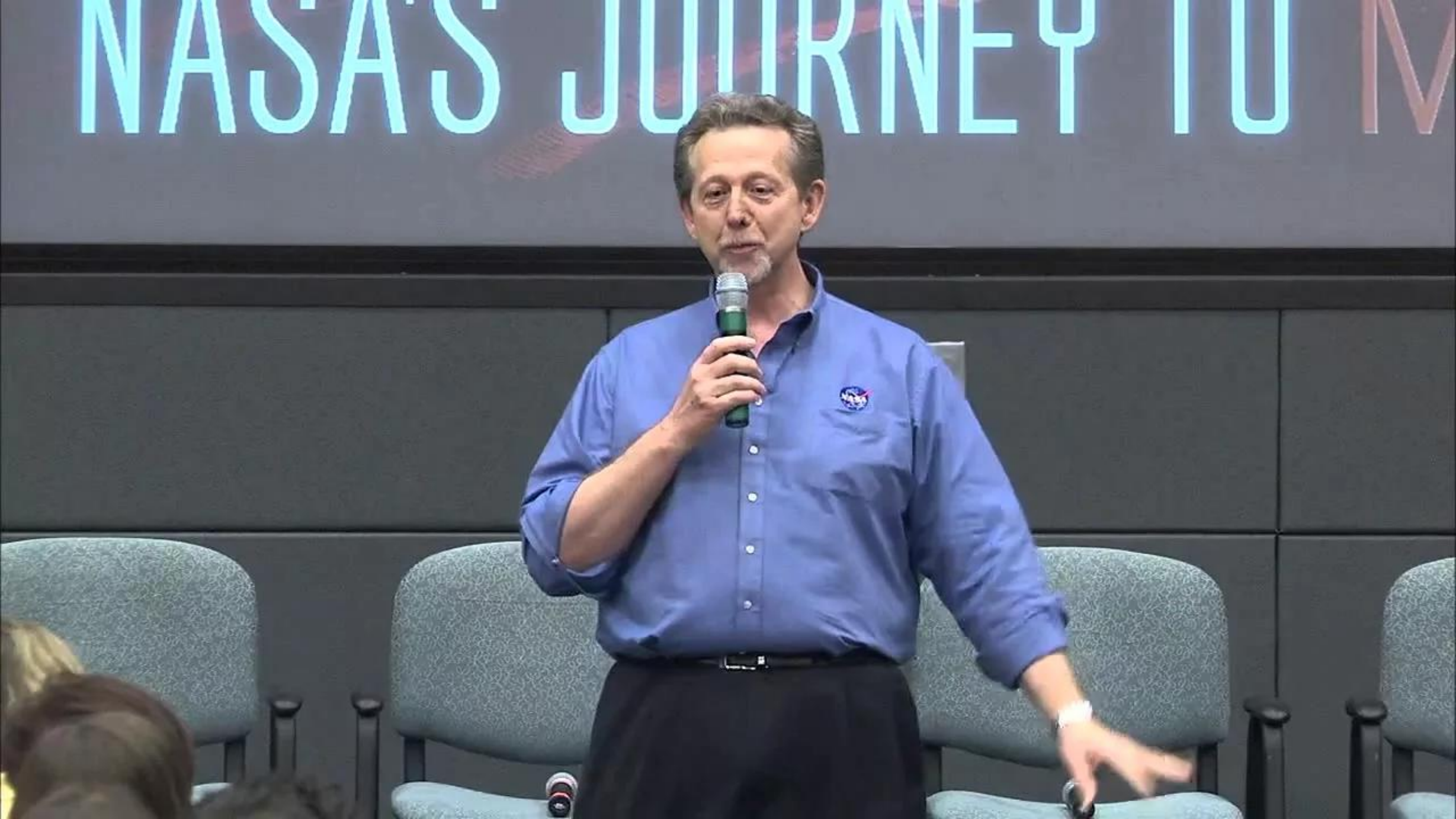
NASA'S JOURNEY TO

1
00:00:02,200 --> 00:00:05,940
I GUARANTEE YOU THAT AT SOME
POINT EVERYTHING IS GOING TO GO

2
00:00:05,940 --> 00:00:07,540
SOUTH ON YOU.
READY?

3
00:00:07,540 --> 00:00:12,490
YOU ARE GOING TO SAY THIS IS
IT.

4
00:00:12,490 --> 00:00:26,410
THIS IS HOW I END.
YOU CAN EITHER ACCEPT THAT OR

5
00:00:26,410 --> 00:00:31,100
YOU CAN GET TO WORK.
THIS WILL COME AS QUITE A

6
00:00:31,100 --> 00:00:38,662
SHOCK TO MY CREW MATES AND TO
NASA AND TO THE ENTIRE WORLD,

7
00:00:38,662 --> 00:00:44,230
BUT I'M STILL ALIVE.
SURPRISE.

8
00:00:44,230 --> 00:00:51,430
IT'S GOING TO BE FOUR YEARS
FOR ANOTHER MISSION TO REACH ME

9
00:00:51,430 --> 00:00:53,989
AND I'M GOING TO HAVE DESIGN TO
LAST 31 DAYS.

10
00:00:53,989 --> 00:00:58,120
I HAVE TO MAKE WATER AND GROW
FOOD ON A PLANET WHERE NOTHING

11
00:00:58,120 --> 00:01:04,699
GROWS.
I CAN FIGURE OUT A WAY TO

12
00:01:04,699 --> 00:01:11,960
CONTACT NASA.
WE HAVE AN INCOMING MESSAGE.

13
00:01:11,960 --> 00:01:17,090
IN YOUR FACE, NEIL ARMSTRONG.
\M THERE MUST BE SOME KIND OF WAY

14
00:01:17,090 --> 00:01:18,780
OUT OF HERE \M
I HAVE ENOUGH FOOD TO LAST

15
00:01:18,780 --> 00:01:21,119
FOR 50 DAYS.
HE IS GOING TO STARVE TO

16
00:01:21,119 --> 00:01:23,829
DEATH LONG BEFORE WE CAN HELP.
I'M GOING TO HAVE TO SCIENCE

17
00:01:23,829 --> 00:01:26,159
THE [BLEEP].
HE IS TOTALLY ALONE.

18
00:01:26,159 --> 00:01:32,900
WHAT IS HE THINKING RIGHT NOW?
I AM THE GREATEST BOTANIST ON

19
00:01:32,900 --> 00:01:39,240
THIS PLANET.
WE EITHER HAVE A HIGH CHANCE

20
00:01:39,240 --> 00:01:41,250
OF KILLING WHITE OR LOW CHANCE
OF KILLING SIX.

21
00:01:41,250 --> 00:01:44,960
IT'S BIGGER THAN ONE PERSON.
NASA REJECTED THE MISSION.

22
00:01:44,960 --> 00:01:45,960
WE ARE TALKING MUTINY.
IF ANYTHING GOES WRONG WE

23
00:01:45,960 --> 00:01:46,960
DIE.
YOU REALIZE HOW CRAZY THIS

24
00:01:46,960 --> 00:01:47,960
IS?
WE HAVE NO OTHER OPTION.

25
00:01:47,960 --> 00:01:59,119
NO MATTER WHAT HAPPENS SHOW THE
WORLD, MY FAMILY THAT I NEVER

26
00:01:59,119 --> 00:02:31,159
STOPPED FIGHTING TO MAKE IT
HOME.

27
00:02:31,159 --> 00:02:42,569
[APPLAUSE]
I'M THE DIRECTOR HERE AT

28
00:02:42,569 --> 00:02:46,390
NASA'S KENNEDY SPACE CENTER AND
I HAVE THE PRIVILEGE OF LEADING

29
00:02:46,390 --> 00:02:50,439
THIS AMAZING TEAM THAT IS
HELPING TAKE US ON A JOURNEY TO

30
00:02:50,439 --> 00:02:54,099
MARS, A REAL JOURNEY TO MARS.
IT'S GOING TO BE AWESOME.

31
00:02:54,099 --> 00:02:56,890
I HAVE A FEW FOLKS I WANT TO
INTRODUCE IN THE AUDIENCE BEFORE

32
00:02:56,890 --> 00:03:00,700
WE GET STARTED.
I EXPECT TO HEAR SOME LOUD

33
00:03:00,700 --> 00:03:05,400
APPLAUSE AS CERTAIN FOLKS ARE
HERE.

34
00:03:05,400 --> 00:03:11,670
FROM COCOA, FLORIDA WE HAVE THE
BIONIC TIGERS.

35
00:03:11,670 --> 00:03:16,080
[APPLAUSE]
AND THESE ARE FIRST ROBOTIC

36
00:03:16,080 --> 00:03:26,559
TEAMS IN THE AREA FROM COCOA
BEACH TEAM PINK.

37
00:03:26,559 --> 00:03:31,569
[APPLAUSE]
I SEE SOME EMPTY SEATS.

38
00:03:31,569 --> 00:03:35,810
FROM TITUSVILLE, COMBAT.
[APPLAUSE]

39
00:03:35,810 --> 00:03:44,790
ALL RIGHT.
AND WE HAVE A TEAM FROM MERIT

40
00:03:44,790 --> 00:03:48,370
ISLAND.
[APPLAUSE]

41
00:03:48,370 --> 00:03:57,629
IN ADDITION TO THAT WE'VE GOT
OVER 10,000 STUDENTS FROM ACROSS

42
00:03:57,629 --> 00:04:01,549
THE UNITED STATES ON NASA'S
LARGEST DISTANCE LEARNING

43
00:04:01,549 --> 00:04:09,330
NETWORK EVENT WE HAVE EVER DONE.
[APPLAUSE]

44
00:04:09,330 --> 00:04:15,249
SO NASA IS ON A JOURNEY TO MARS.
ALREADY FROM THESE SHORES

45
00:04:15,249 --> 00:04:18,980
ROBOTIC PRECURSORS HAVE LAUNCHED
TO THE RED PLANET AND ARE

46
00:04:18,980 --> 00:04:22,910
ROAMING IT RIGHT NOW LEARNING
AND EXPLORING.

47
00:04:22,910 --> 00:04:28,080
RIGHT HERE AT KENNEDY SPACE
CENTER FROM LAUNCH PAD 39 B WE

48
00:04:28,080 --> 00:04:31,170
ARE PREPARING TO LAUNCH HUMANS
TO MARS.

49
00:04:31,170 --> 00:04:36,090
OR RIGHT BEHIND US HAS BEEN
TOTALLY GUTTED OF ALL THE

50
00:04:36,090 --> 00:04:39,190
SHUTTLE INFRASTRUCTURE AND
PUTTING IN THE NEW PLATFORMS TO

51
00:04:39,190 --> 00:04:45,200
SUPPORT A ROCKET MORE CAPABLE
THAN THE SATURN 5.

52
00:04:45,200 --> 00:04:48,140
AND ON TOP OF THAT IS THE ORION
VEHICLE.

53
00:04:48,140 --> 00:04:53,530
ORION CREW VEHICLE THAT'S BEING
BUILT RIGHT HERE IN THE

54
00:04:53,530 --> 00:04:54,850
OPERATIONS AND CHECK OUT
BUILDING.

55
00:04:54,850 --> 00:04:59,360
THAT IS ALL HAPPENING RIGHT NOW.
WE ARE PREPARING TO SEND HUMANS

56
00:04:59,360 --> 00:05:01,640
BEYOND OUR HOME PLANET ONCE
AGAIN.

57
00:05:01,640 --> 00:05:05,850
IT IS ABSOLUTELY AWESOME.
IN ADDITION TO THAT WE ARE

58
00:05:05,850 --> 00:05:14,110
ENABLING COMMERCIAL OPERATIONS
AND THERE ARE JUST ALL KINDS OF

59
00:05:14,110 --> 00:05:18,310
GREAT THINGS GOING ON.
I HAD THE PRIVILEGE OF FLYING ON

60
00:05:18,310 --> 00:05:22,870
A SPACE SHUTTLE FOUR TIMES.
THAT IS ONE HECK OF A RIDE.

61
00:05:22,870 --> 00:05:24,150
WHAT I WOULDN'T GIVE TO DO IT
AGAIN.

62
00:05:24,150 --> 00:05:28,111
WHAT I WOULDN'T GIVE IS TO RIDE
THE SPACE LAUNCH SYSTEM ON A

63
00:05:28,111 --> 00:05:32,810
JOURNEY BEYOND THE HOME PLANET.
THAT IS UP TO YOU GUYS.

64
00:05:32,810 --> 00:05:36,290
I'M LOOKING FORWARD TO SEEING
WHO ENDS UP ON THE FIRST TRIP TO

65
00:05:36,290 --> 00:05:39,660
MARS.
IT IS SOMETHING SPECIAL.

66
00:05:39,660 --> 00:05:42,280
HOW DO YOU BECOME AN
ASTROSNANOT?

67
00:05:42,280 --> 00:05:45,360
YOU HAVE TO MEET THE TECHNICAL
OPERATIONS.

68
00:05:45,360 --> 00:05:51,510
ONE PRIMARY GORE IS PERSISTENCE
AND FINDING YOUR PASSION.

69
00:05:51,510 --> 00:05:54,330
I CHALLENGE ALL OF YOU TO FIND
YOUR PASSION.

70
00:05:54,330 --> 00:05:57,750
A COUPLE OF THINGS HAPPEN.
IF YOU ARE PASSIONATE ABOUT IT

71
00:05:57,750 --> 00:06:00,580
YOU ARE GOING TO DO REALLY WELL.
WE LOOK FOR FOLKS THAT EXCEL IN

72
00:06:00,580 --> 00:06:04,360
THEIR FIELD.
IT IS GOING TO MAKE IT FUN.

73
00:06:04,360 --> 00:06:06,170
AND WORK ISN'T WORK.
IT'S FUN.

74
00:06:06,170 --> 00:06:08,520
THAT IS WHAT IS COOL ABOUT BEING
HERE AT KSC.

75
00:06:08,520 --> 00:06:11,460
I DON'T CARE WHAT YOU ARE DOING
AT KENNEDY SPACE CENTER FOLKS

76
00:06:11,460 --> 00:06:16,540
ARE PASSIONATE ABOUT IT.
I LOVE BEING PART OF THIS TEAM

77
00:06:16,540 --> 00:06:19,930
THAT IS MAKING SCIENCE FICTION
SCIENCE FACT.

78
00:06:19,930 --> 00:06:24,400
IT IS AWESOME.
I WANTED TO BE A PILOT.

79
00:06:24,400 --> 00:06:28,190
FLYING WAS MY PASSION.
AND I GOT DOWN TO PENSACOLA AND

80
00:06:28,190 --> 00:06:32,580
DIDN'T PASS MY EYE TEST.
I BECAME A NAVL FLIGHT OFFICER

81
00:06:32,580 --> 00:06:35,730
FOR THREE YEARS AND FINALLY
CONVINCED THEM.

82
00:06:35,730 --> 00:06:40,480
I PASSED ALL MY EYE TESTS AFTER
THAT AND BACKED DOWN TO

83
00:06:40,480 --> 00:06:45,000
PENSACOLA AND BECAME A NAVALAVE
YEAH ITER.

84
00:06:45,000 --> 00:06:48,990
GOT TO FLY.
AND NOW I SAID I WOULD LIKE TO

85
00:06:48,990 --> 00:06:53,730
USE THAT MATH AND ENGINEERING IN
COLLEGE ALONG WITH MY ABILITIES

86
00:06:53,730 --> 00:06:56,090
TO BE A TEST PILOT.
I APPLIED FOR NAVY TEST PILOT

87
00:06:56,090 --> 00:07:00,870
SCHOOL.
SIX UNGT AMS LATER I GOT PICKED

88
00:07:00,870 --> 00:07:05,880
UP.
NASA IS TAKING APPLICATIONS AND

89
00:07:05,880 --> 00:07:07,980
I APPLIED FOR THE THIRD GROUP OF
SHUTTLE ASTRONAUTS.

90
00:07:07,980 --> 00:07:12,390
I QUALIFIED AND WENT THROUGH THE
PROCESS.

91
00:07:12,390 --> 00:07:16,570
THE CALL CAME AND SAID YOU
DIDN'T MAKE IT.

92
00:07:16,570 --> 00:07:19,620
WAS I CRUSHED.
THEY SAID WE ARE GOING TO TAKE

93
00:07:19,620 --> 00:07:23,120
MORE NEXT YEAR.
I WENT THROUGH THE WHOLE PROCESS

94
00:07:23,120 --> 00:07:26,460
AND REAPPLIED AND WAS FORTUNATE
ENOUGH TO GET SELECTED THE NEXT

95
00:07:26,460 --> 00:07:28,030
YEAR.
I DIDN'T GET INTO PILOT

96
00:07:28,030 --> 00:07:30,290
TRAINING.
DIDN'T GET INTO TEST PILOT

97
00:07:30,290 --> 00:07:34,280
SCHOOL ON THE FIRST TRY OR THE
ASTRONAUT PROGRAM.

98
00:07:34,280 --> 00:07:38,920
SET A GOAL FOR YOURSELF AND
DON'T GIVE UP AND FOLLOW YOUR

99
00:07:38,920 --> 00:07:42,290
PASSION.
DREAMS CAN COME TRUE.

100
00:07:42,290 --> 00:07:46,090
THEY SURE DID FOR ME AND THEY
CAN DO IT FOR YOU, TOO.

101
00:07:46,090 --> 00:07:51,430
SO RIGHT NOW I'D LIKE TO
INTRODUCE NASA'S REAL MARTIAN,

102
00:07:51,430 --> 00:07:56,790
THE HEAD OF PLANETARY SCIENCE
DR. JIM GREEN.

103
00:07:56,790 --> 00:08:04,270
JIM?
THANK YOU VERY MUCH, BOB.

104
00:08:04,270 --> 00:08:10,090
INDEED BEFORE YOU REALLY WATCH
THE MOVIE AND GET ABSORBED IN

105
00:08:10,090 --> 00:08:13,720
THAT, I NEED TO GIVE YOU A
LITTLE BACKGROUND ABOUT MARS.

106
00:08:13,720 --> 00:08:18,170
SO IF WE HAVE THE FIRST SLIDE.
WHAT WE WOULD LIKE TO DO, OF

107
00:08:18,170 --> 00:08:22,390
COURSE, IS TO LEARN TO BE A
MARTIAN.

108
00:08:22,390 --> 00:08:28,150
AND I DON'T SEE MY SLIDES YET.
SO LET ME MENTION A FEW THINGS

109
00:08:28,150 --> 00:08:32,560
WHILE THEY ARE GETTING THEM UP.
THAT IS INDEED BOB IS RIGHT.

110
00:08:32,560 --> 00:08:36,890
IT REALLY TAKES PERSISTENCE.
I HAVE MY OWN STORY IN THAT.

111
00:08:36,890 --> 00:08:40,520
PLEASE REALLY LISTEN TO THAT AND
TAKE HIS ADVICE.

112
00:08:40,520 --> 00:08:43,380
LET'S TALK ABOUT MARS IN ITS
PAST.

113
00:08:43,380 --> 00:08:46,760
MARS LOOKED MUCH MORE LIKE EARTH
3 BILLION YEARS AGO.

114
00:08:46,760 --> 00:08:49,920
WE KNOW THAT NOW.
WE HAVE A ROVER ON THE GROUND

115
00:08:49,920 --> 00:08:55,400
THAT HAS MADE MEASUREMENTS OF
ANCIENT RIVER AND STREAM BEDS.

116
00:08:55,400 --> 00:08:59,520
THE NORTHERN HEMISPHERE OF MARS,
TWO-THIRDS OF ITS NORTHERN

117
00:08:59,520 --> 00:09:04,280
HEMISPHERE WAS UNDER WATER.
THIS ACTUALLY IS A PRETTY GOOD

118
00:09:04,280 --> 00:09:07,700
REPRESENTATION OF WHAT MARS
PROBABLY LOOKED LIKE 3 BILLION

119
00:09:07,700 --> 00:09:10,320
YEARS AGO.
IT'S AT THAT TIME 3 BILLION

120
00:09:10,320 --> 00:09:13,490
YEARS AGO THAT LIFE STARTED HERE
ON EARTH.

121
00:09:13,490 --> 00:09:16,050
AND SO PERHAPS LIFE STARTED ON
MARS.

122
00:09:16,050 --> 00:09:18,700
ONE OF THE THINGS WE HAVE BEEN
TRYING TO DO IS FOLLOW THE

123
00:09:18,700 --> 00:09:20,360
WATER.
WHERE IS THE WATER?

124
00:09:20,360 --> 00:09:25,080
WHERE DID IT GO?
AND INDEED TO BE ABLE TO DO THAT

125
00:09:25,080 --> 00:09:30,740
KIND OF WORK WE NEEDED A ROVER.
OUR ROVERS HAVE LANDED AND WE

126
00:09:30,740 --> 00:09:33,790
HAVE TOURED THROUGH SEVERAL
AREAS THAT WE ARE GOING TO TALK

127
00:09:33,790 --> 00:09:39,550
ABOUT.
FIRST HERE IS A VIEW FROM THE

128
00:09:39,550 --> 00:09:48,060
MARS RECONNAISSANCE ORBITER OF
EVIDENCE OF FLOWING WATER.

129
00:09:48,060 --> 00:09:52,330
HOPEFULLY THIS IS AN ANIMATED
SLIDE.

130
00:09:52,330 --> 00:09:54,720
THAT DIDN'T WORK, EITHER.
NEXT SLIDE, PLEASE.

131
00:09:54,720 --> 00:09:58,940
WE ARE GOING TO KEEP GOING.
WHAT WE FOUND ON MARS IS CRATERS

132
00:09:58,940 --> 00:10:05,750
THAT LITERALLY WEEP.
AND WE NOW KNOW THAT IS MADE OF

133
00:10:05,750 --> 00:10:07,640
WATER.
BECAUSE THE TEMPERATURES ARE SO

134
00:10:07,640 --> 00:10:13,140
LOW ON MARS THAT WATER HAS BEEN
ABLE TO STAY IN THAT FORM BEFORE

135
00:10:13,140 --> 00:10:17,360
IT EVAPORATES AWAY.
HERE IS AN OVERVIEW OF MARS.

136
00:10:17,360 --> 00:10:19,960
HERE IS WHERE WE HAVE PUT THINGS
ON THE GROUND.

137
00:10:19,960 --> 00:10:24,640
THE VIKINGS PATHFINDER WHICH
PLAYS A PROMINENT ROLE IN THE

138
00:10:24,640 --> 00:10:28,370
MOVIE "THE MARTIAN."
PHOENIX WE LANDED SEVERAL YEARS

139
00:10:28,370 --> 00:10:32,700
AGO AND SPIRIT AND OPPORTUNITY.
YOU CAN SEE WHERE THEY ARE.

140
00:10:32,700 --> 00:10:37,150
THE TWO ROVERS WORKING TODAY ARE
OPPORTUNITY AND CURIOSITY.

141
00:10:37,150 --> 00:10:42,450
IN FACT THE NEXT ONE WE ARE
GOING TO LAUNCH RIGHT OUT HERE

142
00:10:42,450 --> 00:10:52,400
ACTUALLY IN VANDENBERG.
THIS IS WHERE IT IS GOING TO

143
00:10:52,400 --> 00:11:00,050
LAND JUST ABOVE CURIOSITY.
HERE IS CURIOSITY.

144
00:11:00,050 --> 00:11:04,710
THIS IS A SELFIE MADE UP OF 54
INDIVIDUAL PICTURES THAT THEY

145
00:11:04,710 --> 00:11:17,380
SENT BACK.
NEXT SLIDE, PLEASE.

146
00:11:17,380 --> 00:11:21,880
WHAT DID CURIOSITY FIND.
CURIOSITY HAS A DRILL.

147
00:11:21,880 --> 00:11:30,150
ITS GONE DOWN BELOW THAT RED
SOIL, WHAT WE CALL PERCOLATES ON

148
00:11:30,150 --> 00:11:33,790
THE SOIL.
WHEN YOU SEE THESE HOLES AND THE

149
00:11:33,790 --> 00:11:37,940
MATERIAL THAT HAS COME UP IT'S
GRAY MARS, A COMPLETELY

150
00:11:37,940 --> 00:11:42,270
DIFFERENT TYPE OF SOILS.
IT'S GOT CARBON, HYDROGEN,

151
00:11:42,270 --> 00:11:47,130
NITROGEN, OXYGEN, PHOSPHORUS AND
SULFUR.

152
00:11:47,130 --> 00:11:51,690
AND IT'S FAR MORE MOIST THAN WE
EVER IMAGINED SO A LOT OF THE

153
00:11:51,690 --> 00:11:55,250
WATER THAT WAS ON MARS ACTUALLY
HAS GONE UNDERGROUND.

154
00:11:55,250 --> 00:11:59,660
NEXT SLIDE, PLEASE.
HERE IS OUR CURRENT ARRAY OF

155
00:11:59,660 --> 00:12:02,890
SATELLITES.
WE HAVE OUR ORBITERS, OUR TWO

156
00:12:02,890 --> 00:12:06,279
ROVERS THAT ARE WORKING.
THE NEXT ONE WE ARE GOING TO

157
00:12:06,279 --> 00:12:10,680
LAUNCH IS IN 2016.
AND THEN GOING TO LAUNCH A

158
00:12:10,680 --> 00:12:16,900
MISSION CALLED TRACE GAS ORBITER
AND THAT WILL ARRIVE LATE IN

159
00:12:16,900 --> 00:12:22,260
2016 ABOUT THE MARCH OR
SEPTEMBER/OCTOBER TIMEFRAME.

160
00:12:22,260 --> 00:12:27,040
IN THE FUTURE DEVELOPING A ROVER
AND WE ARE BUILDING RIGHT NOW

161
00:12:27,040 --> 00:12:31,690
THE MARS 2020 ROVER.
AND THIS WILL LAUNCH IN 2020 AND

162
00:12:31,690 --> 00:12:34,800
OF COURSE IT TAKES ABOUT NINE
MONTHS TO GET THERE.

163
00:12:34,800 --> 00:12:38,680
IT HAS AN ARRAY OF WONDERFUL
INSTRUMENTS AS BRIEFLY SHOWN ON

164
00:12:38,680 --> 00:12:43,860
THE NEXT SLIDE.
SO HERE IS ALL THE INSTRUMENTS.

165
00:12:43,860 --> 00:12:47,900
IT SORT OF LOOKS LIKE CURIOSITY
BUT HAS A WHOLE NEW SET OF

166
00:12:47,900 --> 00:12:51,140
INSTRUMENTS.
THERE IS ONE FROM NORWAY.

167
00:12:51,140 --> 00:12:52,960
THIS IS A GROUND PENETRATING
RADAR.

168
00:12:52,960 --> 00:12:58,450
WE ARE LOOKING FOR AQUAFERS AND
WHERE WATER IS STORED UNDERNEATH

169
00:12:58,450 --> 00:13:02,220
THE SURFACE OF THE PLANET.
NEXT SLIDE, PLEASE.

170
00:13:02,220 --> 00:13:06,600
ONE OF THE REALLY NEAT
EXPERIMENTS IS CALLED MOXIE.

171
00:13:06,600 --> 00:13:12,080
THIS INSTRUMENT, THIS MARS
OXYGEN RESOURCE UTILIZATION

172
00:13:12,080 --> 00:13:13,820
EXPERIMENT.
IT'S AN ACRONYM WITHIN AN

173
00:13:13,820 --> 00:13:19,790
ACRONYM.
THIS BRINGS IN THE CO 2

174
00:13:19,790 --> 00:13:23,860
ATMOSPHERE AND THROUGH A PROCESS
CALLED ELECTROLYSIS POPS OFF AN

175
00:13:23,860 --> 00:13:28,930
OXYGEN, THENCE THE CARBON
MONOXIDE AND STORES THE OXYGEN.

176
00:13:28,930 --> 00:13:32,950
IT DOES IT IN THE MORNING, AT
NOON AND IN THE AFTERNOON.

177
00:13:32,950 --> 00:13:36,160
IT DOES IT AT NIGHT.
IT DOES IT THROUGH THE WHOLE DAY

178
00:13:36,160 --> 00:13:38,470
AND THROUGHOUT OFF AND ON
THROUGH THE WHOLE YEAR.

179
00:13:38,470 --> 00:13:43,110
THIS PROVIDES US A BASELINE FOR
US TO BE ABLE TO UNDERSTAND WHEN

180
00:13:43,110 --> 00:13:47,740
THE MOST EFFICIENT TIMES ARE TO
EXTRACT OXYGEN OUT OF THE VERY

181
00:13:47,740 --> 00:13:52,300
THIN AIR OF MARS THAT WE CAN USE
FOR A WHOLE VARIETY OF THINGS.

182
00:13:52,300 --> 00:13:55,089
FABULOUS INSTRUMENT.
NEXT SLIDE, PLEASE.

183
00:13:55,089 --> 00:13:59,089
WE ARE ALSO DEVELOPING A VARIETY
OF TECHNOLOGIES THAT WE PLAN ON

184
00:13:59,089 --> 00:14:02,500
USING NEXT.
ONE, OF COURSE, IS THE DEEP

185
00:14:02,500 --> 00:14:11,860
SPACE OPTICAL COMMUNICATION.
THE WAY TO GET MORE DATA IS TO

186
00:14:11,860 --> 00:14:16,790
CHANGE THE WAY INSTEAD OF A VERY
LONG RADIO WAVE WE ARE GOING TO

187
00:14:16,790 --> 00:14:20,020
USE THE VERY SHORT WAVE LENGTHS
OF LIGHT.

188
00:14:20,020 --> 00:14:22,540
WE CAN TRANSFER FAR MORE
INFORMATION.

189
00:14:22,540 --> 00:14:25,851
WE ARE GOING TO HAVE
COMMUNICATION FROM NAMARS TO

190
00:14:25,851 --> 00:14:28,540
EARTH.
WE WILL NEED IT BECAUSE WE NEED

191
00:14:28,540 --> 00:14:31,481
THE VIDEO.
WE WILL NEED THE AUDIO AND WE

192
00:14:31,481 --> 00:14:34,430
WILL NEED THE DATA.
IT'S ONLY THAT MECHANISM THAT

193
00:14:34,430 --> 00:14:38,589
WILL ALLOW US TO BRING ALL THAT
BACK IN A VERY TIMELY MANNER.

194
00:14:38,589 --> 00:14:41,980
WE ALSO ARE DEVELOPING SOLAR
ELECTRIC PROPULSION.

195
00:14:41,980 --> 00:14:48,270
THIS IS WHERE WE TAKE A GAS.
WE IONIZE IT MEANING WE POP OFF

196
00:14:48,270 --> 00:14:53,029
SOME ELECTRONS AND ACCELERATE IT
OUT THE BACK OF A SPACE CRAFT.

197
00:14:53,029 --> 00:14:55,740
THAT PUSHES US IN THE OTHER
DIRECTION.

198
00:14:55,740 --> 00:15:03,010
SO IT IS LIKE THE ON STAR TREK
LIKE NOT WHARP SPEED BUT WHAT DO

199
00:15:03,010 --> 00:15:07,649
THEY CALL IT?
IMPULSE SPEED.

200
00:15:07,649 --> 00:15:11,120
LOW LITTLE TRICKLE THAT WE NEED.
THIS IS THE FIRST START OF IT.

201
00:15:11,120 --> 00:15:15,050
THESE ARE GOING TO BE HUGE
ENGINES THAT ALLOW US TO HAUL

202
00:15:15,050 --> 00:15:18,440
TENS OF TONS OF MATERIAL BACK
AND FORTH TO MARS.

203
00:15:18,440 --> 00:15:21,340
WE ARE ALSO DEVELOPING THE
CAPABILITY TO PUT LARGE MASS

204
00:15:21,340 --> 00:15:25,680
DOWN ON THE GROUND.
RIGHT NOW CURIOSITY IS A ONE

205
00:15:25,680 --> 00:15:32,050
METRIC TON ROVER BUT TO SUPPORT
HUMANS WE PROBABLY NEED AN AREA

206
00:15:32,050 --> 00:15:36,950
THAT WILL SUPPORT 40 TONS WORTH
OF HABITATS AND OTHER THINGS

207
00:15:36,950 --> 00:15:38,529
THAT WE'LL NEED TO PUT ON THE
GROUND.

208
00:15:38,529 --> 00:15:42,130
AND OUR THINKING IS WE WILL
PROBABLY DO IT IN SECTIONS, TEN

209
00:15:42,130 --> 00:15:45,390
TONS EACH.
WE WOULD LIKE TO BE ABLE TO DO

210
00:15:45,390 --> 00:15:48,529
MORE BUT IF WE CAN GO IN ORDER
OF MAGNITUDE BETTER THAT WOULD

211
00:15:48,529 --> 00:15:54,070
BE SPECTACULAR.
THE ENTRY LANDING CAPABILITY IS

212
00:15:54,070 --> 00:15:58,930
HOPEFULLY GIVING US THE ORDER
MAGNITUDE ADVANCE AND THAT ARE

213
00:15:58,930 --> 00:16:03,779
KEY TECHNOLOGIES THAT HELP
HUMANS TO MARS HAPPEN.

214
00:16:03,779 --> 00:16:07,610
NEXT SLIDE, PLEASE.
HOW DO WE GET THERE?

215
00:16:07,610 --> 00:16:13,320
IT TAKES HUMAN EXPLORATION TO DO
A VARIETY OF THINGS.

216
00:16:13,320 --> 00:16:17,209
IT TAKES OUR SCIENCE TO LEAD THE
WAY AND IT TAKES TECHNOLOGIES TO

217
00:16:17,209 --> 00:16:20,630
HELP US MAKE IT HAPPEN.
AND NEXT SLIDE, PLEASE.

218
00:16:20,630 --> 00:16:24,399
HOW WE DO THAT IS THE
EXPLORATION ACTIVITIES ARE

219
00:16:24,399 --> 00:16:28,550
CURRENTLY GOING ON ON SPACE
STATION, LOW EARTH ORBIT,

220
00:16:28,550 --> 00:16:32,440
PIONEERING A NUMBER OF THINGS
FROM GROWING FOOD.

221
00:16:32,440 --> 00:16:36,420
WE HAVE GROWN FOOD NOW IN SPACE,
ROMAINE LETTUCE AND DOING OTHER

222
00:16:36,420 --> 00:16:40,330
KINDS OF RESEARCH IN THAT.
LONG TERM ACCESS TO SPACE,

223
00:16:40,330 --> 00:16:43,940
LIVING IN SPACE FOR LONG PERIODS
OF TIME.

224
00:16:43,940 --> 00:16:46,140
ONE OF THE KELLY BROTHERS IS
DOING THAT NOW.

225
00:16:46,140 --> 00:16:50,330
AND, OF COURSE, THE NEXT SLIDE,
WE ARE DEVELOPING THE CAPABILITY

226
00:16:50,330 --> 00:16:53,950
WITH THE SPACE LAUNCH SYSTEM AND
THE ORION CAPSULE TO GO WELL

227
00:16:53,950 --> 00:16:59,149
BEYOND EARTH ORBIT AND INTO DEEP
SPACE.

228
00:16:59,149 --> 00:17:06,730
NEXT SLIDE, PLEASE.
WE ARE DEVELOPING SCIENCE TOOLS

229
00:17:06,730 --> 00:17:10,900
TO GET US THE INFORMATION TO
KNOW WHAT MARS IS REALLY LIKE.

230
00:17:10,900 --> 00:17:13,850
SO IT'S THE COMBINATION OF THESE
THREE ACTIVITIES THAT WILL MAKE

231
00:17:13,850 --> 00:17:18,600
IT HAPPEN.
AND SO THE EVOLUTION OF A

232
00:17:18,600 --> 00:17:29,919
MARTIAN --
I WANT TO INTRODUCE

233
00:17:29,919 --> 00:17:32,669
THE NEXT SEGMENT WHICH IS A
VIDEO.

234
00:17:32,669 --> 00:17:38,470
THIS WILL TELL YOU MUCH MORE
ABOUT EXPLORATION ONGOING TO OUR

235
00:17:38,470 --> 00:17:43,029
JOURNEY ON MARS.
LET'S CUE THAT UP.

236
00:17:43,029 --> 00:17:48,740
FOR THE FIRST TIME SINCE THE
APOLLO MOON LANDINGS NASA IS

237
00:17:48,740 --> 00:17:53,790
PREPARING TO SEND ASTRONAUTS
BEYOND EARTH ORBIT.

238
00:17:53,790 --> 00:17:56,970
AND THIS TIME THE MISSION IS THE
MOST AMBITIOUS WE HAVE EVER

239
00:17:56,970 --> 00:18:15,649
UNDERTAKEN, THE JOURNEY TO MARS.
CARRYING OUT THIS JOURNEY WILL

240
00:18:15,649 --> 00:18:24,899
REQUIRE THE BEST EFFORTS FROM
PROBES TO ASTRONAUTS IN ORBIT TO

241
00:18:24,899 --> 00:18:30,299
ROBUST NEW SPACE VEHICLES.
THE JOURNEY IS ALREADY UNDERWAY

242
00:18:30,299 --> 00:18:33,690
RIGHT HERE RIGHT NOW.
ASTRONAUTS ABOARD THE

243
00:18:33,690 --> 00:18:36,989
INTERNATIONAL SPACE STATION ARE
LEARNING MORE ABOUT LIVING AND

244
00:18:36,989 --> 00:18:40,070
WORKING IN SPACE FOR LONG
PERIODS OF TIME.

245
00:18:40,070 --> 00:18:44,230
VITAL INFORMATION FOR THE
CHALLENGING TRIP TO MARS.

246
00:18:44,230 --> 00:18:49,129
TRANSPORTATION TO AND FROM THE
STATION WILL BE PROVIDED BY OUR

247
00:18:49,129 --> 00:18:52,489
AMERICAN COMMERCIAL CARGO AND
CREW PARTNERS.

248
00:18:52,489 --> 00:18:57,119
NEXT USING THE ORION CREW
VEHICLE AND THE POWERFUL SPACE

249
00:18:57,119 --> 00:19:01,129
LAUNCH SYSTEM ROCKET NASA WILL
MOVE INTO THE PROVING GROUND OF

250
00:19:01,129 --> 00:19:04,489
SPACE AROUND AND BEYOND THE
MOON.

251
00:19:04,489 --> 00:19:08,369
HERE WE WILL CARRY OUT
INCREASINGLY AMBITIOUS MISSIONS

252
00:19:08,369 --> 00:19:12,490
TO TEST OUT NEW SYSTEMS AND
CAPABILITIES NEEDED TO REACH

253
00:19:12,490 --> 00:19:15,559
MARS.
LIKE DEEP SPACE HABITATS AND

254
00:19:15,559 --> 00:19:21,900
ADVANCED PROPULSION SYSTEMS.
EVEN AS WE SPEAK OUR ROBOTIC

255
00:19:21,900 --> 00:19:26,980
SCOUTS ARE ALREADY EXPLORING THE
RED PLANET PREPARING THE WAY FOR

256
00:19:26,980 --> 00:19:31,299
ASTRONAUTS TO JOIN THEM.
ONCE WE HAVE MATURED OUR

257
00:19:31,299 --> 00:19:36,230
CAPABILITIES IN THE PROVING
GROUND WE WILL BE READY FOR

258
00:19:36,230 --> 00:19:40,769
EARTH INDEPENDENCE REACHING OUR
PLANETARY NEIGHBOR NOT JUST AS

259
00:19:40,769 --> 00:19:45,529
TEMPORARY VISITORS BUT AS
PIONEERS EXPANDING HUMAN

260
00:19:45,529 --> 00:20:08,350
PRESENCE INTO OUR SOLAR SYSTEM.
> THANK YOU.

261
00:20:08,350 --> 00:20:11,650
YOU HAVE HEARD FROM TWO OF OUR
EXCELLENT PANELISTS THIS

262
00:20:11,650 --> 00:20:17,200
MORNING, JIM GREEN.
LET'S INTRODUCE THE OTHER THREE.

263
00:20:17,200 --> 00:20:20,309
MY NAME IS SARAH RAMSEY.
I WOULD LIKE TO LET THE

264
00:20:20,309 --> 00:20:24,460
PANELISTS TELL YOU ABOUT
THEMSELVES.

265
00:20:24,460 --> 00:20:29,769
McKENZIE, LET'S START WITH YOU
IF WE CAN.

266
00:20:29,769 --> 00:20:33,980
YOUR CHARACTER WHO I FINISHED
THE BOOK AND THOUGHT WAS ONE OF

267
00:20:33,980 --> 00:20:38,989
MY FAVORITE CHARACTERS.
DO YOU SEE HER AS INSPIRING

268
00:20:38,989 --> 00:20:43,330
YOUNG WOMEN TO WORK FOR NASA?
I THINK THAT IS ALWAYS

269
00:20:43,330 --> 00:20:45,080
HOPEFULLY THE GOAL WITH
REPRESENTATION.

270
00:20:45,080 --> 00:20:51,039
I HAVE HAD THE LUCK OF HANGING
OUT WITH DR. GREEN AND WITH

271
00:20:51,039 --> 00:21:01,629
NICOLE STAUT WHO IS AN ASTRONAUT
WHO LIVED FOR THREE MONTHS AND

272
00:21:01,629 --> 00:21:04,330
JUST GETTING TO TALK TO THEM
DIRECTLY AND HAVE THEM EXPLAIN

273
00:21:04,330 --> 00:21:08,009
THINGS THAT I'M INTERESTED TO ME
IN A WAY THAT DOESN'T FEEL

274
00:21:08,009 --> 00:21:10,500
PROHIBITIVE OR EXCLUSIVE HAS
BEEN SUCH A TREAT.

275
00:21:10,500 --> 00:21:14,570
I THINK THAT IS WHAT MOVIES DO,
AS WELL, THEY GIVE YOU A MODEL

276
00:21:14,570 --> 00:21:23,429
FOR A PERSON TO GET TO KNOW ON A
PERSONAL LEVEL.

277
00:21:23,429 --> 00:21:28,950
THANK YOU.
YOU'RE WORKING ON PROJECTS THAT

278
00:21:28,950 --> 00:21:35,549
I FEEL LIKE MIGHT HAVE FOUND
REALLY USEFUL.

279
00:21:35,549 --> 00:21:41,059
ONE OF THE PROJECTS I WORK ON
HERE WE HAVE A MODULE CALLED

280
00:21:41,059 --> 00:21:47,549
ATMOSPHERE PROCESSING UNIT.
IT CONVERTS OUT THE CARBON

281
00:21:47,549 --> 00:21:51,090
DIOXIDE WHICH IS 95% OF THE
MARTIAN ATMOSPHERE.

282
00:21:51,090 --> 00:21:53,669
IT USES CRYOCOOLERS TO FREEZE IT
OUT.

283
00:21:53,669 --> 00:21:57,920
WE SEND IT OUT TO A REACTOR THAT
CREATES METHANE AND WATER.

284
00:21:57,920 --> 00:22:01,210
SO WE REALLY LIKE METHANE
BECAUSE A LOT OF THE VEHICLES

285
00:22:01,210 --> 00:22:04,299
USE LIQUID OXYGEN LIQUID METHANE
ENGINES.

286
00:22:04,299 --> 00:22:11,260
WATER YOU CAN GET OXYGEN FOR
LIQUID OXYGEN AND HYDROGEN.

287
00:22:11,260 --> 00:22:14,490
IT IS A VERY SUSTAINABLE
REACTION.

288
00:22:14,490 --> 00:22:18,100
IF I WAS HEADING TO MARS I WOULD
LIKE TO KNOW THERE WAS A LANDER

289
00:22:18,100 --> 00:22:22,889
THERE WAITING FOR ME THAT HAD
FUEL READY OR WATER READY FOR A

290
00:22:22,889 --> 00:22:26,390
CREW OR RETURN VEHICLE.
GREAT.

291
00:22:26,390 --> 00:22:30,240
AND I HAVE A VERY IMPORTANT
QUESTION FOR YOU.

292
00:22:30,240 --> 00:22:35,690
ARE POTATOES REALLY THE FUTURE
OF MARTIAN CUISINE?

293
00:22:35,690 --> 00:22:41,889
THEY ARE.
AS YOU KNOW I'M A BOTANIST AND

294
00:22:41,889 --> 00:22:44,640
SPECIFICALLY A PLANT
PHYSIOLOGIST AND I HAVE BEEN

295
00:22:44,640 --> 00:22:49,480
WORKING FOR NASA CLOSE TO 30
YEARS.

296
00:22:49,480 --> 00:22:53,049
I SPENT MOST OF MY CAREER
STUDYING PLANT GROWTH IN CONTROL

297
00:22:53,049 --> 00:22:57,299
ENVIRONMENT SYSTEMS.
THE INTENT IS TO LOOK AT THE

298
00:22:57,299 --> 00:23:02,640
POTENTIAL FOR PLANTS TO PROVIDE
LIFE SUPPORT.

299
00:23:02,640 --> 00:23:06,749
CAN THEY BE USED TO PRODUCE FOOD
AND THROUGH PHOTO SYNTHESIS CAN

300
00:23:06,749 --> 00:23:11,019
THEY GENERATE OXYGEN AND REMOVE
CO 2.

301
00:23:11,019 --> 00:23:14,940
AS IT TURNS OUT I ENDED UP
STUDYING POTATOES IN PARTICULAR

302
00:23:14,940 --> 00:23:18,690
FOR A LOT OF RESEARCH AT THE
UNIVERSITY OF WISCONSIN AND HERE

303
00:23:18,690 --> 00:23:27,749
AT KENNEDY SPACE CENTER.
POTATOES ARE A GOOD CHOICE.

304
00:23:27,749 --> 00:23:31,929
THAT IS REALLY GOOD TO KNOW.
WE ARE GOING TO GET OTHER

305
00:23:31,929 --> 00:23:34,369
QUESTIONS.
WE HAVE GOT AN INCREDIBLE

306
00:23:34,369 --> 00:23:37,859
AUDIENCE ALL ACROSS THE COUNTRY.
WE HAVE ALMOST 10,000 STUDENTS

307
00:23:37,859 --> 00:23:42,340
WATCHING AND WE HAVE SOME
AWESOME STUDENTS HERE IN THE

308
00:23:42,340 --> 00:23:45,580
ROOM AND WE HAVE SOCIAL MEDIA.
IF YOU WOULD LIKE TO SEND US A

309
00:23:45,580 --> 00:23:51,399
QUESTION VIA TWITTER USE
#ASKNASA.

310
00:23:51,399 --> 00:24:15,659
LET'S START WITH SCHOOLS ONLINE.
LET'S GO TO QUESTIONS ON

311
00:24:15,659 --> 00:24:26,129
THE
DLN.

312
00:24:26,129 --> 00:25:03,799
WE

313
00:25:03,799 --> 00:25:15,799
ARE GOING TO GO TO OUR
FIRST QUESTION HERE ON THE FRONT

314
00:25:15,799 --> 00:25:33,080
ROW.
[INAUDIBLE].

315
00:25:33,080 --> 00:25:35,539
I'M TURNING TO THE NASA
HEADQUARTERS GUY.

316
00:25:35,539 --> 00:25:42,220
I'M GOING TO MAKE A COMMENT.
AS FAR AS FUNDING FROM A HUMAN

317
00:25:42,220 --> 00:25:51,919
SPACE FLIGHT POINT OF VIEW
THE

318
00:25:51,919 --> 00:25:57,549
BUDGET IS PRETTY FLAT THROUGHOUT
THE NEXT FEW YEARS.

319
00:25:57,549 --> 00:26:02,259
WE HAVE LAID OUT AN ARCHITECTURE
THAT IS DEVELOPING A CAPABILITY.

320
00:26:02,259 --> 00:26:05,779
ONE OF THE THINGS WE NEED TO GO
TO MARS IS A REALLY BIG ROCKET.

321

00:26:05,779 --> 00:26:13,659
WE HAVE A CREW VEHICLE AND A
ROCKET NETWORK.

322
00:26:13,659 --> 00:26:16,820
IT PERFORMED FLAWLESSLY.
WE ARE FLYING A TEST FLIGHT OF

323
00:26:16,820 --> 00:26:26,980
THE ROCKET IN LATE 2018.
AND THEN OUR GOAL IS TO FLY WITH

324
00:26:26,980 --> 00:26:31,399
A CREW IN 2021.
ONCE WE HAVE PROVEN THAT

325
00:26:31,399 --> 00:26:34,960
CAPABILITY THEN THE MONEY THAT
WAS GOING FOR RESEARCH AND

326
00:26:34,960 --> 00:26:40,100
DEVELOPMENT ON THAT CAPABILITY
NOW DRIFTS OFF.

327
00:26:40,100 --> 00:26:44,919
WE CAN TAKE THAT DELTA AND APPLY
IT TO DEVELOPING A HABIT ABILITY

328
00:26:44,919 --> 00:26:46,889
MODULE.
THE ORION CREW VEHICLE ONLY

329
00:26:46,889 --> 00:26:52,149
SUPPORTS A CREW FOR 21 DAYS.
IF WE WANT TO STAY IN SPACE

330
00:26:52,149 --> 00:26:55,359
LONGER THAN THAT THEN WE HAVE TO
HAVE A HABITABILITY MODULE.

331

00:26:55,359 --> 00:27:02,169
A TRIP TO MARS AND WE ARE
TALKING A YEAR AND A HALF TO TWO

332
00:27:02,169 --> 00:27:03,659
YEARS.
SIX TO EIGHT MONTHS TO GET THERE

333
00:27:03,659 --> 00:27:08,419
AND ANOTHER SIX TO EIGHT MONTHS
ON ANOTHER PLANET.

334
00:27:08,419 --> 00:27:14,270
WE WOULD DEVELOP A HABITABILITY
MODULE TO SUPPORT THE CREW.

335
00:27:14,270 --> 00:27:16,639
WHEN WE GET THERE AND WE ARE
WORKING ON ENTRY, DISSENT AND

336
00:27:16,639 --> 00:27:20,019
LANDING WE WILL NEED SOME SORT
OF LANDER AND A WAY TO GET OFF

337
00:27:20,019 --> 00:27:27,399
THE PLANET.
IT IS VERY WELL STAGED OUT.

338
00:27:27,399 --> 00:27:31,649
I WILL LET JIM TALK ABOUT FROM A
SCIENCE POINT OF VIEW.

339
00:27:31,649 --> 00:27:39,919
[INAUDIBLE].
WE ARE DOING THIS AS PART OF

340
00:27:39,919 --> 00:27:45,570
OUR EXPLORATION AND OUTREACH.
WE HAVE THE EXPLORER TEAM.

341

00:27:45,570 --> 00:27:50,750
WE WANT TO SEE WHAT IS ON THE
OTHER SIDE OF THE HILL.

342
00:27:50,750 --> 00:27:54,149
IT HAS JUST BEEN DELIGHTFUL.
THE ECONOMY REALLY HAD A SLUMP

343
00:27:54,149 --> 00:27:57,720
OVER THE LAST SEVERAL YEARS AND
THE ADMINISTRATION AND CONGRESS

344
00:27:57,720 --> 00:28:03,970
HAVE BEEN REALLY GENEROUS TO
ALLOW OUR BUDGET TO BE FLAT.

345
00:28:03,970 --> 00:28:08,100
WE REALLY OWE IT ALL TO OUR
SUPPORT IN AMERICA TO BE ABLE TO

346
00:28:08,100 --> 00:28:11,120
CONTINUE TO DO THESE THINGS.
WHAT I HOPE YOU GET OUT MORE

347
00:28:11,120 --> 00:28:14,309
THAN ANYTHING ELSE TODAY AND AS
BOB RELAYED VERY WELL WE ARE

348
00:28:14,309 --> 00:28:18,240
MAKING STEADY PROGRESS.
WE HAD PLANS AND PUT THE PLANS

349
00:28:18,240 --> 00:28:21,320
IN PLACE.
WHAT WE ARE FINDING OUT AT MARS

350
00:28:21,320 --> 00:28:25,919
WITH OUR ROBOTIC MISSIONS BOTH
ORBTERES AND THOSE ON THE GROUND

351

00:28:25,919 --> 00:28:30,639
ROLLING AROUND ENABLE US TO MAKE
CONCRETE PLANS ON WHERE WE ARE

352
00:28:30,639 --> 00:28:33,000
GOING TO GO, WHAT WE ARE GOING
TO DO AND HOW WE ARE GOING TO

353
00:28:33,000 --> 00:28:35,389
USE IT.
ALL OF THIS IS COMING TOGETHER

354
00:28:35,389 --> 00:28:39,739
REALLY QUITE NICELY.
I WANT TO THANK YOU FOR ALL YOUR

355
00:28:39,739 --> 00:29:02,949
SUPPORT.
THIS IS OUR QUESTION.

356
00:29:02,949 --> 00:29:18,739
[INAUDIBLE].
WHAT I UNDERSTOOD WAS MARS

357
00:29:18,739 --> 00:29:32,909
ATMOSPHERE IS
SO THIN HOW ARE WE

358
00:29:32,909 --> 00:29:38,529
GOING TO BE ABLE TO LIVE AND
WORK AND LIVE ON MARS?

359
00:29:38,529 --> 00:29:43,669
WELL, INDEED THE ATMOSPHERE OF
MARS IS LESS THAN A PERCENT IN

360
00:29:43,669 --> 00:29:45,919
TERMS OF PRESSURE THAT WE HAVE
HERE.

361

00:29:45,919 --> 00:29:50,250
SO CONSEQUENTLY WE HAVE TO HAVE
AN ENVIRONMENT AND THAT IS HOW

362
00:29:50,250 --> 00:29:56,259
WE WILL WORK AND LIVE.
I THINK THE MOVIE SHOWS A DESIGN

363
00:29:56,259 --> 00:29:59,450
THAT IS VERY WORKABLE.
YOU HAVE TO HAVE ALL SORTS OF

364
00:29:59,450 --> 00:30:02,210
ABILITY TO MOVE.
YOU ARE ALSO GOING TO HAVE

365
00:30:02,210 --> 00:30:04,159
ROVERS.
YOU ARE GOING TO GO TO DIFFERENT

366
00:30:04,159 --> 00:30:07,340
PLACES.
OUR PLANS IN TERMS OF GOING TO

367
00:30:07,340 --> 00:30:10,970
MARS IS GOING TO AN AREA THAT WE
CALL AN EX PLORUATION ZOEN.

368
00:30:10,970 --> 00:30:14,129
IT IS ABOUT 100 KILOMETERS IN
DYNAMETER.

369
00:30:14,129 --> 00:30:19,539
WE ARE GOING TO LIVE IN ANOTHER
LOCATION THERE AND DO SCIENCE

370
00:30:19,539 --> 00:30:22,720
ALL OVER THE PLACE.
AND THAT IS WHY WE ACTUALLY HAVE

371

00:30:22,720 --> 00:30:26,570
TO HAVE LARGER ROVER VEHICLES TO
MAKE THAT TRANSIT FROM PLACE TO

372
00:30:26,570 --> 00:30:29,890
PLACE TO PLACE.
SO WE HAVE IT COVERED AND MAKING

373
00:30:29,890 --> 00:30:34,549
GOOD PROGRESS IN THAT AREA.
I HAVE TO ADMIT WATCHING THE

374
00:30:34,549 --> 00:30:40,090
PREVIEWS HERE I'M REALLY ENVIOUS
OF THAT SUIT.

375
00:30:40,090 --> 00:30:47,330
OUR ADMINISTRATOR HAS BEEN
INVOLVED IN MAKING THOSE CLOSE

376
00:30:47,330 --> 00:30:49,799
FITTING SUITS THAT ALLOW
FLEXIBILITY.

377
00:30:49,799 --> 00:30:54,179
THAT IS RESEARCH THAT NEEDS TO
BE CONTINUED AND PERFECTED.

378
00:30:54,179 --> 00:30:59,509
JUST TO PUT IT IN PERSPECTIVE
WHEN ASTRONAUTS DO A SPACE WALK

379
00:30:59,509 --> 00:31:05,979
THAT SUIT IS A VACUUM.
THAT SUIT WEIGHS LIKE 300 PLUS

380
00:31:05,979 --> 00:31:08,860
POUNDS.
AND IT HAS MULTIPLE LAYERS TO

381

00:31:08,860 --> 00:31:13,230
PROTECT TO PROVIDE PRESSURE TO
THE CREW AND PROVIDE OXYGEN AND

382
00:31:13,230 --> 00:31:16,389
THERMAL PROTECTION.
THEY WEAR A LIQUID COOLING

383
00:31:16,389 --> 00:31:21,769
GARMENT AND IT HAS ALL THESE
SPECIAL JOINTS AND STUFF THAT

384
00:31:21,769 --> 00:31:25,149
THEY CAN MOVE.
ASTRONAUTS WANT SOMETHING MORE

385
00:31:25,149 --> 00:31:30,729
FLEXIBLE, MORE MOBILE ESPECIALLY
DOWN ON THE SURFACE WE DESIGNED

386
00:31:30,729 --> 00:31:39,429
THE SUIT FOR THE SPACE WALKS.
YOU WANT AS MUCH MOBILITY AS YOU

387
00:31:39,429 --> 00:31:46,179
CAN GET AS OPPOSED TO THE SUITS
AS THE APOLLO ASTRONAUTS WORE.

388
00:31:46,179 --> 00:31:48,389
LET'S GO TO A QUESTION HERE
IN THE ROOM.

389
00:31:48,389 --> 00:32:10,289
WHO HAS A QUESTION?
WE ARE GOING TO BRING YOU THE

390
00:32:10,289 --> 00:32:12,460
MICROPHONE.
THAT'S A VERY INTERESTING

391

00:32:12,460 --> 00:32:15,409
IDEA.
I WOULD LIKE TO CHALLENGE YOU TO

392
00:32:15,409 --> 00:32:18,649
PERFECT IT.
AND THEN I WILL LET YOU KNOW HOW

393
00:32:18,649 --> 00:32:24,869
WE CAN GET IT TO MARS AND TEST
IT OUT.

394
00:32:24,869 --> 00:32:28,700
LET'S GO IN THE ROOM.
WE ARE GOING TO TAKE ANOTHER

395
00:32:28,700 --> 00:32:34,120
QUESTION HERE IN THE ROOM.
I KNOW YOU GUYS WERE LIVELY

396
00:32:34,120 --> 00:32:40,889
BEFORE.
DON'T BE SHY.

397
00:32:40,889 --> 00:32:49,320
WHAT WOULD BE THE HARDEST
[INAUDIBLE].

398
00:32:49,320 --> 00:32:56,909
THAT I HAVE NO SKILL SET TO
SURVIVE OTHER THAN RELATING TO

399
00:32:56,909 --> 00:33:01,669
OTHER PEOPLE.
I DON'T THINK I'M PREPARED.

400
00:33:01,669 --> 00:33:05,739
I DID LEARN A LOT ABOUT
CHEMISTRY AND MATH AND THE SORT

401

00:33:05,739 --> 00:33:27,469
OF PERSON THAT COULD SURVIVE.
WE HAVE HAD QUESTIONS COMING IN

402
00:33:27,469 --> 00:33:29,590
VIA SOCIAL MEDIA.
LET'S GET ONE OF THOSE RIGHT

403
00:33:29,590 --> 00:33:44,009
NOW.
[INAUDIBLE].

404
00:33:44,009 --> 00:33:49,049
I THINK IT'S ABSOLUTELY VERY
PLAUSIBLE WHEN ANDY WEIR WROTE

405
00:33:49,049 --> 00:33:56,969
THE BOOK
HE GOT FEEDBACK FROM

406
00:33:56,969 --> 00:34:00,049
ENGINEERS AND NASA SCIENTISTS.
DR. WHEELER HELPED WITH THE

407
00:34:00,049 --> 00:34:04,690
POTATOES.
EVERYTHING THAT HE TALKS ABOUT

408
00:34:04,690 --> 00:34:08,490
IS VERY PLAUSIBLE AND IT COULD
BE.

409
00:34:08,490 --> 00:34:13,039
WHEN WE LOOK TO PICK ASTRONAUTS
WE LOOK FOR FOLKS THAT HAVE

410
00:34:13,039 --> 00:34:15,649
OPERATIONAL SKILLS.
THEY ARE OBVIOUSLY EXPERTS IN

411

00:34:15,649 --> 00:34:19,889
THEIR FIELD.
ONE OF MY FAVORITE STORIES DR.

412
00:34:19,889 --> 00:34:25,450
DON PETT WAS SELECTED TO BE AN
ASTRONAUT ON HIS FIFTH OR SIXTH

413
00:34:25,450 --> 00:34:32,190
TRY WHEN.
WHEN HE WAS 10 YEARS OLD HIS

414
00:34:32,190 --> 00:34:36,720
BROTHER BOUGHT AN AUTOMATIC
TRANSMISSION TO TAKE APART FOR A

415
00:34:36,720 --> 00:34:42,940
BIRTHDAY PRESENT.
THAT IS THE KIND OF GUY DON IS.

416
00:34:42,940 --> 00:34:49,250
HE IS A HANDS ON REALLY SMART
BUT ALSO HAS THAT SKILL SET,

417
00:34:49,250 --> 00:34:51,319
THOSE TOOLS THAT ARE NEEDED TO
IMPROVISE.

418
00:34:51,319 --> 00:34:55,510
AND THAT'S WHAT WE LOOK FOR.
FOLKS THAT CAN BE IN A

419
00:34:55,510 --> 00:34:58,119
CHALLENGING SITUATION.
THEY HAVE PROVEN THEMSELVES IN

420
00:34:58,119 --> 00:35:02,240
SIMILAR SITUATIONS THROUGH
EXPERIENCE SO THAT WHEN

421

00:35:02,240 --> 00:35:07,270
SOMETHING DOES HAPPEN THAT'S OUT
OF THE ORDINARY THEY ARE ABLE TO

422
00:35:07,270 --> 00:35:11,470
COPE WITH IT.
THEY ARE CAPABLE.

423
00:35:11,470 --> 00:35:15,680
I COULDN'T PUT IT DOWN.
WOULD YOU ADD TO SOME OF

424
00:35:15,680 --> 00:35:17,222
THAT?
I THINK THE WORK THAT YOU ARE

425
00:35:17,222 --> 00:35:20,450
WORKING ON IS --
WHEN I WAS READING THE BOOK I

426
00:35:20,450 --> 00:35:24,990
WAS SO EXCITED BECAUSE IT TALKS
ABOUT THE MODULE DROPPED BEFORE

427
00:35:24,990 --> 00:35:27,440
THE CREW ARRIVED.
THAT IS TECHNOLOGY THAT NASA IS

428
00:35:27,440 --> 00:35:32,609
WORKING ON NOW TO DEVELOP.
THAT LIKELY WILL HAPPEN SO FOR

429
00:35:32,609 --> 00:35:35,360
ME TO TURN THE PAGES AND READ
ABOUT SOMETHING THAT I COULD

430
00:35:35,360 --> 00:35:39,609
RELATE TO AT MY JOB TO GET
HUMANS TO MARS JUST WAS AWESOME.

431

00:35:39,609 --> 00:35:42,510
IT WAS A PAGE TURNER FOR ME.
ANOTHER THING I REALLY LIKED

432
00:35:42,510 --> 00:35:46,160
THAT HE SAID IN THE BOOK WAS
TALK ABOUT THE FRUSTRATIONS OF

433
00:35:46,160 --> 00:35:48,940
COMMUNICATION.
IF YOU THINK ABOUT THE ISS THAT

434
00:35:48,940 --> 00:35:51,990
IS REAL-TIME COMMUNICATION.
WHEN WE GO TO MARS THAT IS GOING

435
00:35:51,990 --> 00:35:54,089
TO BE A BIG DELAY IN
COMMUNICATION.

436
00:35:54,089 --> 00:35:58,660
YOU ARE GOING TO HAVE TO A HAVE
A CREW THAT CAN REALLY DO A LOT

437
00:35:58,660 --> 00:36:01,339
ON THEIR OWN.
THAT'S WHY BEING HANDS ON AND

438
00:36:01,339 --> 00:36:05,050
UNDERSTANDING HOW TO BE
INNOVATIVE ON YOUR OWN IS SO

439
00:36:05,050 --> 00:36:08,540
IMPORTANT FOR THAT CREW.
ONE OF THE FUN THINGS THAT IS

440
00:36:08,540 --> 00:36:12,279
KIND OF A JOKE THAT I HAVE IN MY
HEAD BUT I GOT TO GET SENT AWAY

441

00:36:12,279 --> 00:36:19,839
TO FAKE MARS FOR 120 DAYS AND
HAD TO SIMULATE LIVING IN A

442
00:36:19,839 --> 00:36:22,289
MARTIAN ENVIRONMENT AND
INCLUDING THE COMMUNICATION

443
00:36:22,289 --> 00:36:24,849
DELAY.
WE HAD A 40-MINUTE COMMUNICATION

444
00:36:24,849 --> 00:36:28,770
DELAY WITH EVERYTHING.
I THOUGHT THAT WAS WELL CAPTURED

445
00:36:28,770 --> 00:36:32,359
IN THE BOOK AS PART OF A
CHALLENGE THAT THE CREW IS GOING

446
00:36:32,359 --> 00:36:34,700
TO HAVE TO DEAL WITH BECAUSE YOU
ARE NOT ABLE TO PICK UP THE

447
00:36:34,700 --> 00:36:36,910
PHONE AND SAY HOW DOES THE
SYSTEM WORK?

448
00:36:36,910 --> 00:36:39,630
TELL ME NOW.
IT IS FAILING NOW.

449
00:36:39,630 --> 00:36:45,710
I FELT HE DID A GREAT JOB IN THE
BOOK WITH ALL OF THAT.

450
00:36:45,710 --> 00:36:54,200
LET'S GO TO ONE OF OUR
QUESTIONS ON THE DLN.

451

00:36:54,200 --> 00:37:01,800
[INAUDIBLE].
WHAT WOULD AN ASTRONAUT BE

452
00:37:01,800 --> 00:37:10,609
DOING ON THE TRANSIT TO MARS?
MY LONGEST MISSION WAS ONLY

453
00:37:10,609 --> 00:37:14,589
16 DAYS.
ACTUALLY, THIS IS -- SCOTT KELLY

454
00:37:14,589 --> 00:37:24,859
IS ON THE INTERNATIONAL SPACE
STATION FOR A YEAR.

455
00:37:24,859 --> 00:37:27,280
THERE HAVE BEEN RUSSIANS THAT
HAVE FLOWN IN SPACE FOR OVER A

456
00:37:27,280 --> 00:37:30,000
YEAR BUT IT WAS A LONG TIME AGO.
THE UNIQUE THING ABOUT HAVING

457
00:37:30,000 --> 00:37:34,410
SCOTT UP THERE IS THAT SCOTT HAS
AN IDENTICAL TWIN BROTHER, MARK,

458
00:37:34,410 --> 00:37:38,270
DOWN ON EARTH ALSO PARTICIPATING
ALONG WITH SCOTT.

459
00:37:38,270 --> 00:37:42,920
WE ARE GOING TO SEE HOW
MICROGRAVITY EFFECTS SCOTT AND

460
00:37:42,920 --> 00:37:44,780
COMPARE IT TO TRUTH DATA ON
EARTH.

461

00:37:44,780 --> 00:37:49,559
THAT IS PRETTY COOL.
THE CREW ON THE SPACE STATION

462
00:37:49,559 --> 00:37:53,420
THEY HAVE SOME FREE TIME, ALSO.
AND THEY READ.

463
00:37:53,420 --> 00:37:56,500
THEY LISTEN TO MUSIC.
A NUMBER OF ASTRONAUTS HAVE

464
00:37:56,500 --> 00:37:59,200
TAKEN MUSICAL INSTRUMENTS ALONG
WITH THEM.

465
00:37:59,200 --> 00:38:03,359
ON A TRIP TO MARS STORAGE SPACE
IS GOING TO BE VERY, VERY

466
00:38:03,359 --> 00:38:06,520
CRITICAL.
YOU GOING TO HAVE TO REQUIRE TO

467
00:38:06,520 --> 00:38:10,700
TAKE A LOT OF STUFF WITH YOU AND
EVERY EXTRA LITTLE THING WILL

468
00:38:10,700 --> 00:38:18,920
HAVE TO SERVE A PURPOSE.
THERE WILL BE CREW HELP

469
00:38:18,920 --> 00:38:28,640
RELAXATION AS THEY GO TO MARS.
WE SPENT A LOT OF TIME KEEPING

470
00:38:28,640 --> 00:38:32,440
INTERNATIONAL SPACE STATION
OPERATING AS WELL AS DOING

471

00:38:32,440 --> 00:38:34,339
SCIENCE.
IT IS A FULL-TIME JOB.

472
00:38:34,339 --> 00:38:40,380
THE CREW IS ACTIVELY ENGAGED
EVERY DAY ON THAT JOURNEY.

473
00:38:40,380 --> 00:38:41,760
EXERCISE IS GOING TO BE
EXTREMELY IMPORTANT.

474
00:38:41,760 --> 00:38:47,790
THE CREW HAS MANDATORY EXERCISE
TWO HOURS A DAY AND IT'S AEROBIC

475
00:38:47,790 --> 00:38:50,500
EXERCISE, STRENGTH TRAINING,
RUNNING ON A TREADMILL.

476
00:38:50,500 --> 00:38:53,599
WE FIND RUNNING ON A TREADMILL
YOU NEED IMPACT ON THE TREADMILL

477
00:38:53,599 --> 00:38:59,570
ON THE BONES TO HELP STEM
CALCIUM LOSS.

478
00:38:59,570 --> 00:39:03,730
WE HAVE WEIGHT TRAINING.
YOU HAVE TO HAVE STRENGTH

479
00:39:03,730 --> 00:39:08,520
TRAINING TO STOP CALCIUM LOSS
PLUS AFTER SIX TO EIGHT MONTHS

480
00:39:08,520 --> 00:39:11,450
IN WEIGHTLESSNESS YOU DON'T WANT
TO GET TO MARS AND NOT BE ABLE

481

00:39:11,450 --> 00:39:16,061
TO OPERATE.
YOU ARE STILL GOING TO HAVE TO

482
00:39:16,061 --> 00:39:19,160
BE MOBILE AND MOVE AROUND.
YOU NEED PHYSICAL FITNESS

483
00:39:19,160 --> 00:39:21,359
TRAINING.
THEY WILL BE EXERCISING AND

484
00:39:21,359 --> 00:39:26,670
MAINTAINING THE VEHICLE AND
SCIENCE EXPERIMENTS AND THEY

485
00:39:26,670 --> 00:39:32,960
WILL HAVE SOME FREE TIME TO JUST
INTERACT AND BE NORMAL.

486
00:39:32,960 --> 00:39:40,089
I HAVE A QUESTION FOR YOU.
WHO IN THE ASTRONAUT CORPS IS

487
00:39:40,089 --> 00:39:50,490
MOST LIKELY TO TAKE DISCO.
MARK WATTNY GOT STUCK LISTENING

488
00:39:50,490 --> 00:39:56,109
TO DISCO.
THAT'S INTERESTING.

489
00:39:56,109 --> 00:39:59,779
I'LL HAVE TO THINK ABOUT IT.
YOU DON'T ACTUALLY HAVE TO

490
00:39:59,779 --> 00:40:01,740
SAY.
WE DON'T WANT TO EMBARRASS THEM.

491

00:40:01,740 --> 00:40:05,829
IT WOULDN'T BE ME.
THAT PERIOD OF MUSIC CAN GO AWAY

492
00:40:05,829 --> 00:40:11,790
AS FAR AS I'M CONCERNED.
LET'S GO TO ANOTHER QUESTION

493
00:40:11,790 --> 00:40:15,350
HERE IN THE ROOM.
WHO HAS A QUESTION?

494
00:40:15,350 --> 00:40:28,000
I KNOW IN THE MOVIE
[INAUDIBLE] AND YOU WERE

495
00:40:28,000 --> 00:40:36,500
TALKING ABOUT PLANTING POTATOES.
WELL, MAYBE JIM CAN WEIGH IN

496
00:40:36,500 --> 00:40:40,480
ON THIS, TOO.
GROWING PLANTS INSIDE A CONTROL

497
00:40:40,480 --> 00:40:43,250
ENVIRONMENT IS ONE THING AND
THAT HAS ITS CHALLENGES.

498
00:40:43,250 --> 00:40:47,070
THAT IS A LOT EASIER IF YOU HAVE
A CONTROLLED ENVIRONMENT.

499
00:40:47,070 --> 00:40:51,670
IF YOU HAVE THE WATER AND THE
LIGHT AND THE NUTRIENTS.

500
00:40:51,670 --> 00:40:54,600
ON THE OUTSIDE MARTIAN
ENVIRONMENT WHERE IT IS VERY

501

00:40:54,600 --> 00:40:59,720
EXTREME IN TERMS OF TEMPERATURE
AND CHANGES, THE LOW ATMOSPHERIC

502
00:40:59,720 --> 00:41:04,460
PRESSURE, THE HIGH UV RADIATION,
THAT IS MUCH MORE CHALLENGING

503
00:41:04,460 --> 00:41:20,640
AND SO

504
00:41:20,640 --> 00:41:24,470
ONCE THAT COULD TAKE
PLACE THEN MAYBE THE ENVIRONMENT

505
00:41:24,470 --> 00:41:29,670
WOULD BE SUPPORTIVE OF THE TERA
FORM.

506
00:41:29,670 --> 00:41:31,210
I DON'T KNOW IF YOU HAVE
ANYTHING.

507
00:41:31,210 --> 00:41:36,549
WHAT WILL HAPPEN IS
SCIENTISTS WILL RESIST THE IDEA

508
00:41:36,549 --> 00:41:38,750
OF TERA FORM.
WE WANT TO KNOW ABOUT THE

509
00:41:38,750 --> 00:41:44,380
CURRENT STATE OF THE PLANET.
WE WOULD RATHER NOT MODIFY IT IN

510
00:41:44,380 --> 00:41:47,859
ANY WAY.
I WILL TELL YOU THIS.

511
00:41:47,859 --> 00:41:52,029

NATURE WILL MODIFY IT.
THE AVERAGE TEMPERATURE OF MARS

512
00:41:52,029 --> 00:41:55,710
WILL CONTINUE TO INCREASE.
IF IT INCREASES UP TO ABOUT 7

513
00:41:55,710 --> 00:42:01,859
DEGREES THAT IS ENOUGH TO START
MELTING THE CO 2 POLAR CAP.

514
00:42:01,859 --> 00:42:05,660
UNDERNEATH THAT CO 2 POLAR CAP
IS WATER ICE.

515
00:42:05,660 --> 00:42:10,339
WHEN YOU MELT THE CO 2 POLAR CAP
THAT WILL HEIGHTEN THE PRESSURE

516
00:42:10,339 --> 00:42:13,640
AND THAT WILL GIVE YOU MORE OF A
GREENHOUSE EFFECT THAT WILL

517
00:42:13,640 --> 00:42:17,500
THEN, ALSO, INCREASE THE
TEMPERATURE OF THE PLANET.

518
00:42:17,500 --> 00:42:22,480
AND THEN THE WATER ICE WILL MELT
AND A SIGNIFICANT PART OF THAT

519
00:42:22,480 --> 00:42:27,099
LOST OCEAN WILL COME BACK.
AND MARS WILL LOOK MORE LIKE

520
00:42:27,099 --> 00:42:31,990
EARTH AT THAT ERA THAN IT HAS IN
3 BILLION YEARS.

521
00:42:31,990 --> 00:42:35,269

WHEN WE LOOK AT OUR PLANETS WE
ARE REALLY LOOKING AT THEM IN A

522
00:42:35,269 --> 00:42:40,260
SNAPSHOT IN TIME AND THEY ARE
ALL GOING THROUGH A SERIES OF

523
00:42:40,260 --> 00:42:42,290
EVOLUTIONS.
THAT IS WHAT WE WANT TO

524
00:42:42,290 --> 00:42:44,660
UNDERSTAND.

525
00:42:44,660 --> 00:42:46,710
.
I HAVE MY REASONS.

526
00:42:46,710 --> 00:42:55,609
IT'S A QUESTION NOT ASKED.
WHY SHOULD WE GO TO MARS?

527
00:42:55,609 --> 00:43:00,010
AS I SAID WE ARE EXPLORERS.
THIS IS A HUGE STEP FOR US.

528
00:43:00,010 --> 00:43:03,599
I SEE SEVERAL WITH PHONES AND
COMPUTERS IN PARTICULAR.

529
00:43:03,599 --> 00:43:06,730
I'M SURE YOU WILL ALWAYS BACK UP
YOUR COMPUTERS.

530
00:43:06,730 --> 00:43:11,520
WE ACTUALLY NEED A PLACE TO BACK
UP THE HUMAN RACE.

531
00:43:11,520 --> 00:43:13,890
THE DINOSAURS DIDN'T HAVE A

SPACE PROGRAM.

532
00:43:13,890 --> 00:43:18,890
WE KNOW AN ENORMOUS AMOUNT ABOUT
OUR ENVIRONMENT AND THE

533
00:43:18,890 --> 00:43:21,760
ENVIRONMENT THAT WE ARE IN IN
THE SOLAR SYSTEM.

534
00:43:21,760 --> 00:43:27,329
THERE ARE, INDEED, EARTH OBJECTS
THAT ARE LARGE THAT WILL IMPACT

535
00:43:27,329 --> 00:43:29,670
THE EARTH.
IT'S NOT A MATTER OF IF.

536
00:43:29,670 --> 00:43:32,700
IT'S A MATTER OF WHEN.
IN THE LAST FIVE BILLION YEARS

537
00:43:32,700 --> 00:43:33,920
THERE HAVE BEEN FIVE MASS

538
00:43:33,920 --> 00:43:36,980
EXTINCTIONS.
IF THE HUMAN RACE IS GOING TO

539
00:43:36,980 --> 00:43:41,240
SURVIVE ON THIS PLANET WE HAVE
TO MOVE.

540
00:43:41,240 --> 00:43:43,640
IT DOESN'T MEAN WE ARE ALL GOING
TO GO.

541
00:43:43,640 --> 00:43:46,450
WE HAVE TO BE ABLE TO BACK UP
OUR HUMAN RACE.

542
00:43:46,450 --> 00:43:50,890
THAT IS ALSO PART OF OUR MAKEUP.
THAT IS WHAT MAKES US UNIQUELY

543
00:43:50,890 --> 00:43:54,480
HUMAN.
YOU CAN'T STOP IT EVEN IF YOU

544
00:43:54,480 --> 00:43:59,109
WANTED TO.
LET'S GO TO ONE OF OUR

545
00:43:59,109 --> 00:44:06,359
QUESTIONS FROM THE DLN.
MY NAME IS PAGE SMITH IN

546
00:44:06,359 --> 00:44:13,470
WISCONSIN.
MY QUESTION IS HOW LONG HAS MARS

547
00:44:13,470 --> 00:44:17,029
BEEN STUDIED?
GOOD QUESTION.

548
00:44:17,029 --> 00:44:23,200
THIS YEAR IT WAS AUGUST OF THIS
YEAR MARKED OUR 50TH ANNIVERSARY

549
00:44:23,200 --> 00:44:27,039
OF THE STUDYING MARS.
THE FIRST MISSION OF MARS WE

550
00:44:27,039 --> 00:44:30,869
FLEW BY IT.
WHEN IT HAPPENED THE SCIENTISTS

551
00:44:30,869 --> 00:44:38,270
WEREN'T JOYFUL BECAUSE THE AREA
WE SAW MOSTLY WAS CRATERED AND

552
00:44:38,270 --> 00:44:40,390
WE THOUGHT MARS LOOKED MORE LIKE
THE MOON.

553
00:44:40,390 --> 00:44:44,410
AND IT ACTUALLY SETBACK MARS
EXPLORATION FOR MANY YEARS AFTER

554
00:44:44,410 --> 00:44:47,180
THAT.
AFTER OUR FLY BYS WE DECIDED WE

555
00:44:47,180 --> 00:44:51,779
NEEDED ORBITERS.
SO IN 1969-1970 WE STARTED WITH

556
00:44:51,779 --> 00:44:55,960
OUR ORBTERES AND THEN WE BEGAN
TO REALIZE HOW COMPLEX MARS

557
00:44:55,960 --> 00:44:58,920
REALLY IS.
IT HAS CLOUDS.

558
00:44:58,920 --> 00:45:02,619
IT HAS SNOW.
IT SNOWS ON MARS.

559
00:45:02,619 --> 00:45:10,599
THE SEASONS ARE THERE.
IT HAS HUGE CANYONS THAT IF IT

560
00:45:10,599 --> 00:45:15,319
IS IN THE UNITED STATES IT WOULD
LINK THE ATLANTIC AND THE

561
00:45:15,319 --> 00:45:19,099
PACIFIC TOGETHER.
IT'S GOT SHIELD VOLCANOS BIGGER

562
00:45:19,099 --> 00:45:23,240
THAN THE STATE OF MISSOURI.
IT'S AN UNBELIEVEBLY BEAUTIFUL

563
00:45:23,240 --> 00:45:27,510
PLANET IN MANY WAYS AND REALLY
CHANGED OUR OPINION OF IT.

564
00:45:27,510 --> 00:45:31,170
NOW THE MORE WE KNOW ABOUT THE
RESOURCES THAT ARE THERE THE

565
00:45:31,170 --> 00:45:36,730
MORE WE RECOGNIZE THAT THIS
PLANET IS MOST LIKE EARTH AND

566
00:45:36,730 --> 00:45:42,450
THE ONE THAT WE CAN GO TO.
I BELIEVE THERE IS A PERSON OR

567
00:45:42,450 --> 00:45:46,230
NUMBER OF PEOPLE ALIVE TODAY
THAT WILL BE THE FIRST PEOPLE ON

568
00:45:46,230 --> 00:45:49,279
MARS.
MAYBE SOMEBODY IN THIS ROOM?

569
00:45:49,279 --> 00:45:53,520
I HOPE SO.
I WOULD LIKE TO MEET YOU.

570
00:45:53,520 --> 00:45:55,530
LET'S TAKE A QUESTION FROM IN
THE ROOM.

571
00:45:55,530 --> 00:46:00,369
YOU STILL HAVE A QUESTION?
SOMEBODY RAISED THEIR HAND

572
00:46:00,369 --> 00:46:03,950
EARLIER.
LET'S GO RIGHT HERE.

573
00:46:03,950 --> 00:46:13,220
WHY DOES SPACE EXPLORATION
SEEM TO BE DECREASING.

574
00:46:13,220 --> 00:46:18,170
WE WENT FROM LOW EARTH ORBIT TO
THE MOON WITH THE APOLLO

575
00:46:18,170 --> 00:46:22,100
MISSIONS AND SINCE THEN WE ONLY
SEND HUMANS TO LOW EARTH ORBIT

576
00:46:22,100 --> 00:46:25,470
AGAIN.
DO YOU FEEL WE NEED COMPETITION

577
00:46:25,470 --> 00:46:33,549
RIVALRY FOR SCIENCE TO DEVELOP?
IT WAS ABSOLUTELY AMAZING

578
00:46:33,549 --> 00:46:36,849
WHAT WE DID DURING THE APOLLO
PROGRAM WHEN YOU CONSIDER THAT

579
00:46:36,849 --> 00:46:44,690
ELLEN SHEPHERD FLEW THE FIRST
FLIGHT IN MAY OF 1961 AND HE DID

580
00:46:44,690 --> 00:46:49,609
A PARABOLIC ARC UP INTO SPACE
AND CAME OVER THE ATLANTIC OCEAN

581
00:46:49,609 --> 00:46:56,890
AND WE WERE WALKING ON THE MOON.
WE HAD 4.5% OF THE FEDERAL

582
00:46:56,890 --> 00:47:03,140
BUDGET.
WE HAVE LEARNED A LOT.

583
00:47:03,140 --> 00:47:07,210
GIVEN THE RESOURCES I THINK THAT
WE ARE DOING AN OUTSTANDING JOB.

584
00:47:07,210 --> 00:47:11,619
WE TRANSITIONED FROM THE APOLLO
PROGRAM.

585
00:47:11,619 --> 00:47:14,589
WE DID SKY LAB, OUR FIRST SPACE
STATION.

586
00:47:14,589 --> 00:47:17,380
WE DID THE APOLLO TEST PROJECT
WITH THE RUSSIANS.

587
00:47:17,380 --> 00:47:19,910
WE TRANSITIONED TO SHUTTLE.
SHUTTLE WOULD HAVE FLOWN SOONER

588
00:47:19,910 --> 00:47:24,790
BUT GOT DELAYED.
APRIL 12, 1981 FLEW THE FIRST

589
00:47:24,790 --> 00:47:31,599
SHUTTLE MISSION AND WE HAD THE
MOST AWESOME SHUTTLE PROGRAM.

590
00:47:31,599 --> 00:47:34,760
IT WAS FANTASTIC WHAT WE
ACCOMPLISHED, ALL THE SCIENCE

591
00:47:34,760 --> 00:47:36,960
MISSIONS, HUBBLE SPACE
TELESCOPE, BUILDING THE

592
00:47:36,960 --> 00:47:40,190
INTERNATIONAL SPACE STATION.
NOW WITH THE INTERNATIONAL SPACE

593
00:47:40,190 --> 00:47:43,070
STATION WE KNOW HOW TO GET BACK
AND FORTH.

594
00:47:43,070 --> 00:47:47,250
IT IS TIME TO TRANSITION LOW
EARTH ORBIT OVER TO THE

595
00:47:47,250 --> 00:47:51,410
COMMERCIAL SECTOR SO NASA CAN
FOCUS ON THE HARD JOB OF

596
00:47:51,410 --> 00:47:54,400
EXPLORING BEYOND OUR HOME
PLANET.

597
00:47:54,400 --> 00:47:58,970
I THINK THE COURSE THAT WE HAVE
LAID OUT IS A VERY GOOD ONE AND

598
00:47:58,970 --> 00:48:03,860
WE ARE GOING TO MAKE IT HAPPEN.
GREAT.

599
00:48:03,860 --> 00:48:16,670
DO WE HAVE A QUICK QUESTION FROM
SOCIAL MEDIA?

600
00:48:16,670 --> 00:48:21,410
THIS QUESTION COMES FROM
TWITTER.

601
00:48:21,410 --> 00:48:24,539
HOW ARE WE PROTECTING MARS'
ENVIRONMENT AS WE EXPLORE THE

602
00:48:24,539 --> 00:48:29,130
SURFACE?
SO WHEN WE LAUNCH SPACE CRAFT

603
00:48:29,130 --> 00:48:34,910
AND WE KNOW WHAT THE
REQUIREMENTS ARE WE ALSO STUDY

604
00:48:34,910 --> 00:48:38,009
HOW THAT SPACECRAFT MIGHT EFFECT
THE ENVIRONMENT THEY ARE GOING

605
00:48:38,009 --> 00:48:39,859
TO.
WE CALL THAT PLANETARY

606
00:48:39,859 --> 00:48:43,160
PROTECTION.
WE HAVE IN NASA A PLANETARY

607
00:48:43,160 --> 00:48:46,589
PROTECTION OFFICER.
WE INTERACT WITH KATHIE

608
00:48:46,589 --> 00:48:49,390
CONNELLY, PLANETARY PROTECTION
OFFICER.

609
00:48:49,390 --> 00:48:53,820
AND SHE HELPS US THROUGH MAKING
THE DECISIONS ON WHAT WE NEED TO

610
00:48:53,820 --> 00:48:56,980
DO TO BE ABLE TO PROTECT THE
ENVIRONMENT WE ARE GOING TO.

611
00:48:56,980 --> 00:49:00,200
GIVE YOU AN EXAMPLE.
WE HAVE A SPACECRAFT RIGHT NOW

612
00:49:00,200 --> 00:49:06,270
ORBITING SATURN.
SATURN HAS FABULOUS MOONS, ONE

613
00:49:06,270 --> 00:49:10,771
OF WHICH HAS AN ATMOSPHERE THAT
IS LIKE OURS IN THE SENSE THAT

614
00:49:10,771 --> 00:49:14,259
IT IS MOSTLY NITROGEN.
IT IS A WONDERFUL WORLD.

615
00:49:14,259 --> 00:49:17,750
IT HAS LIQUID ON THE SURFACE AND
WE WOULD NOT WANT TO CONTAM NATE

616
00:49:17,750 --> 00:49:23,930
IT BY HAVING IT CRASH ON TITAN.
SO WE ARE GOING TO DITCH INTO

617
00:49:23,930 --> 00:49:27,640
SATURN AND WE ARE GOING TO START
THE PROCESS ABOUT SEPTEMBER OF

618
00:49:27,640 --> 00:49:30,070
NEXT YEAR.
AND IT WILL TAKE US A YEAR TO

619
00:49:30,070 --> 00:49:34,430
GET INTO POSITION.
THESE ARE THE THINGS WE HAVE TO

620
00:49:34,430 --> 00:49:38,250
CONSIDER WHEN WE LAUNCH OUR
SPACECRAFT.

621
00:49:38,250 --> 00:49:43,460
SO WOULD YOU ALL JOIN ME IN
ENG THANKING OUR PANEL FOR THEIR

622
00:49:43,460 --> 00:49:52,880
TIME?
[APPLAUSE]

623
00:49:52,880 --> 00:49:57,009
IN JUST A MINUTE WE ARE GOING TO
HEAR FROM WILLIAM LEWIS WHO IS

624
00:49:57,009 --> 00:50:01,390
ONE OF OUR INTERNS HERE AT
KENNEDY SPACE CENTER.

625
00:50:01,390 --> 00:50:03,630
YOU CAN GET INVOLVED WITH NASA
RIGHT NOW.

626
00:50:03,630 --> 00:50:06,380
WE HAVE CITIZEN SCIENCE
PROJECTS.

627
00:50:06,380 --> 00:50:09,540
WE HAVE STUDENT CHALLENGES.
WE HAVE GREAT PRIZES AND

628
00:50:09,540 --> 00:50:12,170
CHALLENGES MEANT JUST FOR
STUDENTS LIKE FUTURE ENGINEERS

629
00:50:12,170 --> 00:50:15,109
CHALLENGE AND WE HAVE
OPPORTUNITIES AT EACH OF OUR

630
00:50:15,109 --> 00:50:17,829
NASA CENTERS FOR STUDENTS TO
BECOME INTERNS.

631
00:50:17,829 --> 00:50:23,000
I JUST WANT TO REMIND EVERYONE
THAT YOU CAN CONTINUE TO SEND US

632
00:50:23,000 --> 00:50:25,390
QUESTIONS WITH THE HASHTAG
ASKNASA.

633
00:50:25,390 --> 00:50:28,410
IF YOU WOULD LIKE MORE
INFORMATION ABOUT WHAT OUR

634
00:50:28,410 --> 00:50:34,839
PANELISTS TALKED ABOUT OR LEARN
MORE VISIT

635
00:50:34,839 --> 00:50:57,269
NASA.GOV/REALMARTIANS.
YOU CAN LEARN MORE.

636
00:50:57,269 --> 00:51:01,339
I WORK ON AN INSTRUMENT
CALLED SAMPLE ANALYSIS AT MARS

637
00:51:01,339 --> 00:51:05,410
ON THE CURIOSITY ROVER.
IT MEASURES CHEMICAL COMPOSITION

638
00:51:05,410 --> 00:51:07,839
IN THE SURFACE OF THE ATMOSPHERE
AT MARS.

639
00:51:07,839 --> 00:51:11,460
MY PARTICULAR INTEREST IS
NITROGEN COMPOUND.

640
00:51:11,460 --> 00:51:14,369
ONE COOL THING WE FOUND IS
NITRATES.

641
00:51:14,369 --> 00:51:22,200
IT'S USED BY BIOLOGY TO MAKE
BIO MOLECULES SUCH AS AMUNEO

642
00:51:22,200 --> 00:51:24,700
ACIDS.
WORKING ON SAMPLE ANALYSIS AT

643
00:51:24,700 --> 00:51:28,820
MARS AND THE CURIOSITY ROVER IS
AWESOME BECAUSE WE ARE MAKING

644
00:51:28,820 --> 00:51:31,839
THESE COMPLEX CHEMICAL
MEASUREMENTS ON THE SURFACE OF

645
00:51:31,839 --> 00:51:34,410
ANOTHER PLANET.
THESE ARE MEASUREMENTS DIFFICULT

646
00:51:34,410 --> 00:51:38,940
SOMETIMES TO MAKE IN YOUR OWN
LABORATORY AND YET WE ARE DOING

647
00:51:38,940 --> 00:51:47,420
IT ON THE SURFACE OF MARS AND
GETTING DATA.

648
00:51:47,420 --> 00:51:52,940
ALL RIGHT.
HOW IS EVERYBODY DOING TODAY?

649
00:51:52,940 --> 00:51:56,170
[APPLAUSE]
IT'S WONDERFUL INTRODUCTION.

650
00:51:56,170 --> 00:52:01,460
I AM AN INTERN FOR KENNEDY SPACE
CENTER, THE BEST PLACE TO WORK

651
00:52:01,460 --> 00:52:05,220
IN THE NATION.
GIVE IT UP FOR KENNEDY SPACE

652
00:52:05,220 --> 00:52:11,720
CENTER.
I AM ONE STOP SHOPPING

653
00:52:11,720 --> 00:52:15,369
INITIATIVE.
NASA DESIGNED A WONDERFUL WAY TO

654
00:52:15,369 --> 00:52:18,470
ALLOW ALL NEXT SCIENTISTS,
ENGINEERS AND ASTRONAUTS TO

655
00:52:18,470 --> 00:52:21,569
APPLY TO NASA AS SOON AS THEY
GRADUATE.

656
00:52:21,569 --> 00:52:27,500
ALL YOU HAVE TO DO IS LOG ON,
CREATE A SIMPLE PROFILE, UPLOAD

657
00:52:27,500 --> 00:52:31,500
THE NECESSARY INFORMATION SUCH
AS YOUR ENROLLED UNIVERSITY OF

658
00:52:31,500 --> 00:52:34,710
CHOICE, ALL OF YOUR RESUMES,
TRANSCRIPTS, ALL THE THINGS THAT

659
00:52:34,710 --> 00:52:37,380
MAKE YOU AWESOME.
SELECT THE SPACE CENTER THAT YOU

660
00:52:37,380 --> 00:52:40,630
WANT TOBE AN INTERN FOR AND
WAIT.

661
00:52:40,630 --> 00:52:43,589
YOU CAN READ AND REREAD THE
MARTIAN UNTIL YOU KNOW IT FRONT

662
00:52:43,589 --> 00:52:47,269
AND BACK.
I AM GOING TO GIVE YOU A LITTLE

663
00:52:47,269 --> 00:52:49,060
MORE INFORMATION ON HOW TO BE AN
INTERN.

664
00:52:49,060 --> 00:52:55,089
THERE ARE A FEW WAYS TO DO IT.
I CAN GIVE YOU THE OBVIOUS WAY.

665
00:52:55,089 --> 00:52:59,160
BY A SHOW OF HANDS WHO WANTS TO
HEAR THE UNSPOKEN WAY.

666
00:52:59,160 --> 00:53:02,869
UNSPOKEN WAY IT IS.
A FEW PRO TIPS.

667
00:53:02,869 --> 00:53:08,089
PRO TIP NUMBER ONE DON'T LET
YOUR DREAMS BE DREAMS.

668
00:53:08,089 --> 00:53:11,839
DREAMS ARE THE FIRST THING WE
OWN IN THIS WORLD.

669
00:53:11,839 --> 00:53:14,730
THEY ARE THE MOST VALUABLE THING
TO US.

670
00:53:14,730 --> 00:53:16,789
NOBODY CAN TAKE THIS AWAY FROM
YOU.

671
00:53:16,789 --> 00:53:21,910
EVEN WHEN EVERYONE ELSE IS
TELLING YOU NO AND YOU CAN'T DO

672
00:53:21,910 --> 00:53:27,779
IT YOUR DREAMS STAY THE SAME.
YOUR DREAMS STAY AS YOU SEE FIT.

673
00:53:27,779 --> 00:53:30,630
TAKE CARE OF THEM.
PROTIP NUMBER TWO.

674
00:53:30,630 --> 00:53:33,809
BE THE BEST YOU CAN BE.
MAKE THE BEST OF ANY SITUATION

675
00:53:33,809 --> 00:53:39,039
THAT YOU HAVE AND ALL YOUR
DREAMS WILL COME TRUE.

676
00:53:39,039 --> 00:53:42,099
I HAVE BEEN IN SITUATIONS WHERE
I THOUGHT THIS IS IMPOSSIBLE.

677
00:53:42,099 --> 00:53:46,720
I DON'T HAVE ENOUGH RESOURCES.
I NEED MORE TIME.

678
00:53:46,720 --> 00:53:51,060
AS SAID THEY NEED ASTRONAUTS
THAT CAN PERFORM IN THE MOST

679
00:53:51,060 --> 00:53:55,420
CRITICAL SITUATIONS.
NOT EVERYONE WILL BE IDEAL.

680
00:53:55,420 --> 00:53:57,910
IT IS UP TO YOU TO MAKE THE BEST
OF IT.

681
00:53:57,910 --> 00:54:03,670
THAT IS HOW YOU KNOW YOU WILL BE
THE BEST YOU CAN BE AND YOU CAN

682
00:54:03,670 --> 00:54:08,079
REALIZE ALL OF YOUR DREAMS.
JUST HAVE FUN.

683
00:54:08,079 --> 00:54:11,190
ENJOY THE JOURNEY.
LIFE IS A JOURNEY.

684
00:54:11,190 --> 00:54:13,330
TAKE ADVANTAGE OF ALL OF THE
MOMENTS TO MAKE THE BEST OF

685
00:54:13,330 --> 00:54:19,640
EVERYTHING.
NOW, JUST KEEP IN MIND THAT NO

686
00:54:19,640 --> 00:54:22,740
MATTER WHAT COMES YOUR WAY, NO
MATTER WHAT OBSTACLES YOU HAVE

687
00:54:22,740 --> 00:54:25,140
TO FACE YOU CAN OVERCOME THEM.
YOU ARE AWESOME.

688
00:54:25,140 --> 00:54:28,400
I WANT EVERYBODY IN THE AUDIENCE
AND AT HOME TO LOOK TO THEIR

689
00:54:28,400 --> 00:54:34,210
NEIGHBOR AND SAY NEIGHBOR -- ACT
LIKE YOU LIKE EACH OTHER.

690
00:54:34,210 --> 00:54:43,210
SAY NEIGHBOR, YOU BE YOU AND I
WILL BE ME.

691
00:54:43,210 --> 00:54:44,210
THANK YOU.
THANK YOU.

692
00:54:44,210 --> 00:54:45,650
[APPLAUSE]

693
00:54:45,650 --> 00:54:49,849
THAT'S ALL I HAVE.
THAT'S ALL I HAVE FOR TODAY.

694
00:54:49,849 --> 00:54:52,990
NEXT UP WE ARE GOING TO HEAR
FROM THE INCREDIBLE DIRECTOR OF

695
00:54:52,990 --> 00:54:56,269
"THE MARTIAN."
TO HEAR WHAT THEY HAD TO GO

696
00:54:56,269 --> 00:54:58,599
THROUGH TO DESIGN THIS
INCREDIBLE MOVIE.

697
00:54:58,599 --> 00:55:03,450
MARS IS LIKE THAT.
WE LIVE THERE.

698
00:55:03,450 --> 00:55:11,150
WHAT SECRETS DOES IT HOLD?
HOW SOON MIGHT HUMANS BE ABLE TO

699
00:55:11,150 --> 00:55:14,259
GO THERE?
THESE QUESTIONS FASCINATED ME AS

700
00:55:14,259 --> 00:55:21,520
A FILM MAKER.
SENDING HUMANS TO MARS SAFELY IS

701
00:55:21,520 --> 00:55:24,420
A PRIORITY IN NASA.
IT STARTED THE LANDING OF

702
00:55:24,420 --> 00:55:30,890
ROBOTIC ROVERS SUCH AS SPIRIT,
OPPORTUNITY AND CURIOSITY.

703
00:55:30,890 --> 00:55:35,420
THE DATA AND IMAGES SENT BACK TO
WORK HAVE PIQUED OUR

704
00:55:35,420 --> 00:55:46,299
IMAGINATION.
HUMANS ARE PREPARING FOR THIS

705
00:55:46,299 --> 00:55:49,910
JOURNEY BY LIVING AT THE
INTERNATIONAL SPACE STATION

706
00:55:49,910 --> 00:55:54,329
WHERE THERE IS NO GRAVITY.
THE ROUND TRIP TO MARS.

707
00:55:54,329 --> 00:55:58,809
THE JOURNEY REQUIRES THE MOST
SOPHISTICATED TECHNOLOGY EVER

708
00:55:58,809 --> 00:56:03,249
BUILT INCLUDING THE NEW ORION
SPACE CRAFT.

709
00:56:03,249 --> 00:56:08,059
WHEN WE INVENT NEW TECHNOLOGIES
FOR SPACE EXPLORATION IT

710
00:56:08,059 --> 00:56:13,569
BENEFITS ALL OF HUMANITY
CONTRIBUTING TO BREAK THROUGHS.

711
00:56:13,569 --> 00:56:18,519
THE JOURNEY TO MARS WILL CHANGE
HISTORY BOOKS FOREVER REWRITING

712
00:56:18,519 --> 00:56:26,220
WHAT WE KNOW ABOUT THE RED
PLANET.

713
00:56:26,220 --> 00:56:36,630
FOLLOW NASA'S JOURNEY TO MARS AT
NASA.GOV.

714
00:56:36,630 --> 00:56:40,270
[APPLAUSE]
WE HAVE A WHOLE NEW SET OF

715
00:56:40,270 --> 00:56:46,641
EXPERTS HERE WITH US TO TALK
ABOUT "THE MARTIAN" AND HOW WE

716
00:56:46,641 --> 00:57:03,650
ARE GETTING READY FOR FUTURE
EXPLORATION.

717
00:57:03,650 --> 00:57:06,609
TELL YOU GUYS MORE ABOUT WHAT
THEY ARE WORKING ON RIGHT NOW.

718
00:57:06,609 --> 00:57:11,060
I'M GOING TO START OFF WITH
DAVE.

719
00:57:11,060 --> 00:57:19,160
IF YOU CAN LAND ON ONE PLACE ON
MARS WHERE WOULD THAT BE AND

720
00:57:19,160 --> 00:57:23,190
WHY?
IF I COULD PICK ONE PLACE I

721
00:57:23,190 --> 00:57:27,740
WOULD GO BACK TO THE MARS
PATHFINDER LANDING SITE.

722
00:57:27,740 --> 00:57:29,859
FOR A COUPLE OF DIFFERENT
REASONS.

723
00:57:29,859 --> 00:57:33,490
ACTUALLY, ONE OF THE ROLES I HAD
IN WORKING WITH THE FILM IS I

724
00:57:33,490 --> 00:57:37,630
WAS ONE OF THE NASA CONSULTANTS
WITH THE GROUP.

725
00:57:37,630 --> 00:57:40,119
ONE OF THE THINGS THAT I
CONTRIBUTED WAS LOT OF KNOWLEDGE

726
00:57:40,119 --> 00:57:43,480
ABOUT MARS AND PATHFINDER AS THE
FILM MAKERS WERE TRYING TO

727
00:57:43,480 --> 00:57:46,299
DISPLAY WHAT THAT ROVER WAS
LIKE.

728
00:57:46,299 --> 00:57:51,170
THEY HAD A LOT OF DRAWINGS AND
PHOTOGRAPHS BECAUSE PATHFINDER

729
00:57:51,170 --> 00:57:55,390
WAS THE FIRST MARS MISSION THAT
I WORKED ON IN MY NASA CAREER.

730
00:57:55,390 --> 00:57:57,410
I HAVE A LOT OF CONNECTION WITH
THAT ONE.

731
00:57:57,410 --> 00:58:02,940
I WOULD LIKE TO FIND OUT WHAT
HAPPENED TO OUR ROVER?

732
00:58:02,940 --> 00:58:06,190
ONE THING THAT IS TOUCHED ON
QUICKLY IN THE BOOK BUT YOU

733
00:58:06,190 --> 00:58:10,940
DON'T GET TOO MUCH OUT OF IT IS
THE FACT THAT IF YOU REALLY ASK

734
00:58:10,940 --> 00:58:17,430
US CAREFULLY WE DON'T KNOW WHERE
IT IS.

735
00:58:17,430 --> 00:58:22,150
THE WAY MARS PATHFINDER WORKS IS
WE COMMUNICATED TO THE ROVER.

736
00:58:22,150 --> 00:58:29,509
THE LANDER DIED FIRST.
WE LOST THE COMMUNICATION

737
00:58:29,509 --> 00:58:37,970
PATHWAY.
WE DON'T KNOW WHERE IT ENDED UP.

738
00:58:37,970 --> 00:58:42,970
I WOULD LIKE TO GO BACK AND FIND
MY ROVER SOMEDAY.

739
00:58:42,970 --> 00:58:56,069
CAN YOU TELL US ABOUT HOW YOU
PREPPED FOR THE ROLE IN THE

740
00:58:56,069 --> 00:58:59,420
MOVIE?
WELL, IT WAS A FEW DIFFERENT

741
00:58:59,420 --> 00:59:02,580
THINGS AND A FEW DIFFERENT
APPROACHES TO IT.

742
00:59:02,580 --> 00:59:07,859
THE FIRST THING WAS, OF COURSE,
CONVERSATION WHICH THE FIRST

743
00:59:07,859 --> 00:59:11,350
CONVERSATION WAS TALKING ABOUT
THE FILM IN VERY BROAD TERMS AND

744
00:59:11,350 --> 00:59:13,230
TALKING ABOUT THE CHARACTER IN
BROAD TERMS.

745
00:59:13,230 --> 00:59:18,319
THEN IT WAS THE BOOK AND THEN
THE SCREEN PLAY.

746
00:59:18,319 --> 00:59:24,180
AND WICKAPEDIA OPEN ALL THE TIME
TRYING TO CROSS REFERENCE

747
00:59:24,180 --> 00:59:26,520
EVERYTHING.
I LEARN AS MUCH AS I COULD ABOUT

748
00:59:26,520 --> 00:59:29,249
IT.
IT WAS A COMPLETELY NEW WORLD

749
00:59:29,249 --> 00:59:32,010
FOR ME.
LITERALLY.

750
00:59:32,010 --> 00:59:34,809
AND I WAS VERY EXCITED IN THAT
PROCESS.

751
00:59:34,809 --> 00:59:39,020
AND THEN I GOT A CHANCE -- WE
SHOT THE FILM IN BUDAPEST.

752
00:59:39,020 --> 00:59:43,190
SO I GOT A CHANCE TO SPEAK TO
PEOPLE FROM THE EUROPEAN SPACE

753
00:59:43,190 --> 00:59:46,549
AGENCY.
AT THAT TIME THEY WERE JUST

754
00:59:46,549 --> 00:59:49,779
LANDING ON THE COMET THAT THEY
SUCCESSFULLY LANDED ON SO I GOT

755
00:59:49,779 --> 00:59:54,710
A FIRST-HAND LOOK AT THE
EXCITEMENT AND THE SORT OF

756
00:59:54,710 --> 00:59:59,170
PROJECT LEADERSHIP THAT WAS
HAPPENING THERE AND OBVIOUSLY

757
00:59:59,170 --> 01:00:03,319
THE STRESS AND THE COMPLICATIONS
OF THE KIND OF WORK.

758
01:00:03,319 --> 01:00:07,349
SO IT WAS A COMBINATION OF THOSE
THINGS THAT KIND OF ALLOWED ME

759
01:00:07,349 --> 01:00:14,460
TO GET AN INSIGHT INTO THE SORT
OF MINDSET OF THE AGENCY.

760
01:00:14,460 --> 01:00:17,490
SO THAT WAS A VERY EXCITING PART
OF LEARNING ABOUT IT ALL.

761
01:00:17,490 --> 01:00:18,619
FANTASTIC.
THANK YOU.

762
01:00:18,619 --> 01:00:23,069
NICOLE, I AM GOING TO ASK YOU
THE SAME QUESTIONS BUT FROM A

763
01:00:23,069 --> 01:00:25,930
DIFFERENT PERSPECTIVE.
AS AN ASTRONAUT IF YOU COULD

764
01:00:25,930 --> 01:00:30,150
LAND ONE PLACE ON MARS WHERE
WOULD IT BE?

765
01:00:30,150 --> 01:00:33,170
WOW.
I THINK I WOULD WANT TO LAND

766
01:00:33,170 --> 01:00:36,859
WHEREVER DAVE OR DR. GREEN TELL
ME TO LAND.

767
01:00:36,859 --> 01:00:40,519
GOOD ANSWER.
AND, YOU KNOW, QUITE HONESTLY

768
01:00:40,519 --> 01:00:45,710
AS ASTRONAUTS WE ARE KIND OF
IMPLEMENTERS OF THE EXPERTS, THE

769
01:00:45,710 --> 01:00:49,420
SCIENTISTS, OUR MANAGERS'ITION
AM.

770
01:00:49,420 --> 01:00:55,329
AND THAT'S A REALLY WONDERFUL
THING TO NOT HAVE TO BE THAT

771
01:00:55,329 --> 01:00:58,440
EXPERT, AS WELL.
AND NASA DOES A REALLY GOOD JOB

772
01:00:58,440 --> 01:01:03,380
OF TRAINING US FOR WHAT WE NEED
TO KNOW ABOUT THE SCIENCE OR THE

773
01:01:03,380 --> 01:01:07,589
SYSTEMS OR WHERE WE ARE GOING
AND THAT KIND OF THING.

774
01:01:07,589 --> 01:01:10,521
I THINK THE WAY THEY DO THAT
THEN ALLOWS US LIKE WHAT IS

775
01:01:10,521 --> 01:01:16,499
SHOWN IN THE MOVIE TO IMP ROVISE
IF WE NEED TO, TO REACT IN

776
01:01:16,499 --> 01:01:21,960
ALMOST A PREDICTABLE WAY AS A
CREW, TO KIND OF RALLY IN A

777
01:01:21,960 --> 01:01:27,619
CALM, DIRECTED WAY TO ADDRESS
PROBLEMS THAT COME UP.

778
01:01:27,619 --> 01:01:30,810
YOU CAN PRETTY MUCH GUARANTEE
THAT PROBABLY NO DAY OR ACTIVITY

779
01:01:30,810 --> 01:01:33,440
WILL GO EXACTLY AS IT WAS
PLANNED.

780
01:01:33,440 --> 01:01:36,220
EVEN ON THE SPACE STATION
ALTHOUGH WE HAVE PRETTY MUCH

781
01:01:36,220 --> 01:01:39,480
CONTINUOUS ABILITY TO
COMMUNICATE THERE ARE TIMES

782
01:01:39,480 --> 01:01:47,059
WHERE WE DON'T CONTACT THE
CONTROL CENTER OR ISSUES TAKES

783
01:01:47,059 --> 01:01:51,490
THAT AWAY FROM US.
YOU HAVE TO BE ON YOUR TOES OR

784
01:01:51,490 --> 01:01:55,831
FLOAT ON YOUR TOES AND BE ABLE
TO THINK QUICKLY AND WORK AS A

785
01:01:55,831 --> 01:01:59,839
CREW IN A WAY YOU WOULD EXPECT
EACH OTHER TO RESPOND.

786
01:01:59,839 --> 01:02:07,490
I LOVE IN THIS MOVIE HOW THE
EXCITEMENT KICKS OFF WITH THE

787
01:02:07,490 --> 01:02:11,960
CREW DOING EXACTLY THAT.
IT'S HITTING THE FAN AND THEY

788
01:02:11,960 --> 01:02:18,269
RESPOND IN A VERY -- I DON'T
WANT TO SAY EMOTIONLESS WAY BUT

789
01:02:18,269 --> 01:02:22,489
THE KIND OF WAY YOU NEED TO DEAL
WITH EACH OTHER AND TO BE

790
01:02:22,489 --> 01:02:27,170
SUCCESSFUL.
I'LL GO WHERE DAVE AND DR. GREEN

791
01:02:27,170 --> 01:02:30,680
TELL ME.
GIOIA, TELL US ABOUT GROWING

792
01:02:30,680 --> 01:02:38,609
FOOD IN SPACE.
I WILL TELL YOU A STORY AS TO

793
01:02:38,609 --> 01:02:42,480
WHY IT IS IMPORTANT.
IMAGINE THAT YOU ARE ON THE

794
01:02:42,480 --> 01:02:46,880
LONGEST PLANE RIDE OR CAR RIDE
THAT YOU HAVE EVER BEEN ON.

795
01:02:46,880 --> 01:02:49,739
IT GETS REALLY BORING AND YOU
ARE IN THIS CRAMPED SPACE AND

796
01:02:49,739 --> 01:02:54,660
YOU CAN'T GO OUTSIDE AND YOU ARE
EATING FOOD THAT MAY BE NOT HOME

797
01:02:54,660 --> 01:03:00,400
COOKED.
IMAGINE THAT 100 FOLD.

798
01:03:00,400 --> 01:03:05,739
NOT JUST ONE DAY OF A REALLY
LONG TRIP BUT 100 DAYS OR

799
01:03:05,739 --> 01:03:08,400
LONGER.
WHEN YOU GET THERE YOU ARE ON

800
01:03:08,400 --> 01:03:13,170
THIS PLACE THAT IS EXTREME AND
DANGEROUS AND ALIEN AND SCARY

801
01:03:13,170 --> 01:03:18,390
AND BEAUTIFUL AND EXCITING BUT
NOT HOME.

802
01:03:18,390 --> 01:03:23,079
AND THE TRIP BACK IS GOING TO BE
MAYBE THE SAME LENGTH AS THE

803
01:03:23,079 --> 01:03:26,140
TRIP OUT BUT WILL PROBABLY FEEL
EVEN LONGER.

804
01:03:26,140 --> 01:03:29,380
THINK OF THE THINGS THAT YOU
WOULD MISS, THE SIGHTS, SMELLS.

805
01:03:29,380 --> 01:03:32,790
YOU MISS THE FAMILY AND FRIENDS
OBVIOUSLY.

806
01:03:32,790 --> 01:03:37,779
THE TASTE OF HOME.
IMAGINE THAT SCENARIO IF YOU HAD

807
01:03:37,779 --> 01:03:40,640
A GARDEN.
THINK ABOUT WHAT THAT GARDEN

808
01:03:40,640 --> 01:03:45,670
MIGHT MEAN TO YOU FOR THIS TRIP,
SOMETHING TO ANTICIPATE, TO MARK

809
01:03:45,670 --> 01:03:49,900
CHANGES IN THE PASSAGE OF TIME.
SOMETHING TO CARE FOR AND

810
01:03:49,900 --> 01:03:53,720
SOMETHING TO REALLY GET EXCITED
ABOUT, THAT FIRST SALAD YOU ARE

811
01:03:53,720 --> 01:03:58,480
ABLE TO HARVEST THAT YOU GREW
YOURSELF, THAT WONDERFUL FLAVOR,

812
01:03:58,480 --> 01:04:01,609
TEXTURE OF A STRAWBERRY THAT YOU
GREW.

813
01:04:01,609 --> 01:04:04,369
SO I THINK THAT THAT'S REALLY
CRITICAL.

814
01:04:04,369 --> 01:04:07,970
A LOT OF OTHER PEOPLE DO, TOO.
THAT'S WHY I'M WORKING TO HELP

815
01:04:07,970 --> 01:04:19,789
ENABLE GARDENS FOR MARS.
MICHAEL, WE LEARNED FROM ANDY

816
01:04:19,789 --> 01:04:23,730
WEIR EARLIER HE ADMITTED THAT
THE MARTIAN DUST STORM WAS

817
01:04:23,730 --> 01:04:30,579
DRAMATIC LICENSE AND WOULDN'T
HAPPEN LIKE THAT.

818
01:04:30,579 --> 01:04:32,680
DUST IS A PROBLEM FOR HUMANS ON
MARS.

819
01:04:32,680 --> 01:04:35,230
TELL US A LITTLE BIT ABOUT HOW
YOU ARE WORKING ON THAT.

820
01:04:35,230 --> 01:04:38,779
I ASSUME THAT THE CREATIVE
LICENSE THAT YOU ARE TALKING

821
01:04:38,779 --> 01:04:43,559
ABOUT IS AT THE BEGINNING OF THE
MOVIE A DUST STORM THAT SETS OFF

822
01:04:43,559 --> 01:04:48,670
THE STORY OF THE MARTIAN.
THE THING WE HAVE TO REMEMBER IS

823
01:04:48,670 --> 01:04:52,609
THE MARS ATMOSPHERE IS VERY
THIN.

824
01:04:52,609 --> 01:04:58,730
AND SO AS A RESULT EVEN THOUGH
WE MIGHT HAVE VERY HIGH VELOCITY

825
01:04:58,730 --> 01:05:02,609
WIND, THE FORCE THAT WE
EXPERIENCE MIGHT NOT BE MUCH

826
01:05:02,609 --> 01:05:06,140
MORE THAN WHAT WE EXPERIENCE
HERE AS A BREEZE ON EARTH.

827
01:05:06,140 --> 01:05:08,950
BUT IT DOESN'T MEAN THAT DUST
STORMS AREN'T AN ISSUE.

828
01:05:08,950 --> 01:05:14,010
DUST STORMS ARE AN ISSUE BECAUSE
WE HAVE DUST IN DUST STORMS.

829
01:05:14,010 --> 01:05:20,380
IF YOU LOOK AT EXPLORATION
MISSIONS WHETHER APOLLO OR MORE

830
01:05:20,380 --> 01:05:24,760
RECENT MISSIONS TO MARS YOU SEE
DUST HAS ALWAYS PLAYED A ROLE IN

831
01:05:24,760 --> 01:05:29,210
THE DESIGN AND IMPLEMENTATION OF
THE VEHICL IF YOU LOOK AT

832
01:05:29,210 --> 01:05:33,849
APOLLO MISSIONS YOU WILL SEE
THEY ARE COMPLETELY COVERED IN

833
01:05:33,849 --> 01:05:37,450
DUST.
WHEN YOU COMPARE THAT TO THE

834
01:05:37,450 --> 01:05:43,980
AMOUNT OF TIME USED FOR FUTURE
MISSIONS THERE ARE THINGS WE

835
01:05:43,980 --> 01:05:47,700
NEED TO WORK OUT.
IF YOU LOOK AT THE MARS

836
01:05:47,700 --> 01:05:51,089
EXPLORATION ROVERS YOU NOTICE
THAT SOLAR PANELS ARE COVERED

837
01:05:51,089 --> 01:05:53,749
WITH DUST.
IF YOU LOOK AT THE CURIOSITY

838
01:05:53,749 --> 01:05:58,680
ROVER YOU NOTICE WHAT USED TO BE
PRISTINE WHITE IS A RUSTISH

839
01:05:58,680 --> 01:06:02,630
COLOR.
NASA IS CURRENTLY DEVELOPING

840
01:06:02,630 --> 01:06:07,980
TECHNOLOGIES THAT WILL ELIMINATE
OR SIGNIFICANTLY LIMIT THE

841
01:06:07,980 --> 01:06:11,329
EFFECTS OF DUST ON THE MARTIAN
SURFACE.

842
01:06:11,329 --> 01:06:17,319
WHETHER THAT BE ACTUALLY ON
SURFACES OR THROUGH RESOURCE

843
01:06:17,319 --> 01:06:20,220
UTILIZATION PLANS.
THE MARS ATMOSPHERE IS VERY

844
01:06:20,220 --> 01:06:23,520
DUSTY AND HAVE WAYS TO REMOVE
DUST FROM THE ATMOSPHERE BEFORE

845
01:06:23,520 --> 01:06:28,730
WE SEND THEM TO THE CHEMICAL
PROCESSING PLANTS.

846
01:06:28,730 --> 01:06:31,710
THE BOTTOM LINE IS DUST IS AN
ISSUE AND WE ARE WORKING ON A

847
01:06:31,710 --> 01:06:35,980
WAY TO SOLVE THAT PROBLEM.
GREAT.

848
01:06:35,980 --> 01:06:39,580
WE HAVE OUR STUDENTS ONLINE
AGAIN SO LET'S GO TO ONE OF OUR

849
01:06:39,580 --> 01:06:42,779
QUESTIONS ON THE DLN.
HI.

850
01:06:42,779 --> 01:06:48,420
THIS IS LAURA FLANGON.
THE STUDENTS FROM DOUGLAS MIDDLE

851
01:06:48,420 --> 01:06:53,619
SCHOOL WANT TO KNOW WHAT
TECHNOLOGY OR ADVANCEMENTS ARE

852
01:06:53,619 --> 01:06:58,520
NECESSARY FOR HUMANS TO LIVE ON
MARS?

853
01:06:58,520 --> 01:07:02,440
THAT'S A GREAT QUESTION.
WHO WOULD LIKE TO START WITH

854
01:07:02,440 --> 01:07:05,359
THAT?
I'LL TAKE AN INITIAL WHACK AT

855
01:07:05,359 --> 01:07:07,430
IT.
THE REAL ANSWER TO YOUR QUESTION

856
01:07:07,430 --> 01:07:13,069
IS ALL OF THEM.
RIGHT NOW WE HAVE A BASIC IDEA

857
01:07:13,069 --> 01:07:16,089
OF WHAT TECHNOLOGIES.
WE HAVE EXPERIENCE WITH WHAT

858
01:07:16,089 --> 01:07:19,160
TECHNOLOGIES IT TAKES TO GET
ROVERS AND ROBOTIC SYSTEMS TO

859
01:07:19,160 --> 01:07:23,599
MARS AND WE ARE GETTING KIND OF
GOOD AT THAT.

860
01:07:23,599 --> 01:07:30,470
THE LEAP IT TAKES TO MOVE FROM
ROBOTIC SYSTEMS WHERE WE MAY BE

861
01:07:30,470 --> 01:07:36,270
LANDING ON THE ORDER OF ONE
METRIC TON AT A TIME TO HUMAN

862
01:07:36,270 --> 01:07:41,309
SYSTEMS GETTING TO THE SURFACE
OF MARS WHERE WE ARE LANDING

863
01:07:41,309 --> 01:07:45,170
MORE THAN AN ORDER OF MAGNITUDE
AND CLOSE TO TWO ORDERS OF

864
01:07:45,170 --> 01:07:46,940
MAGNITUDE, MORE MASS ON THE
SURFACE.

865
01:07:46,940 --> 01:07:51,460
SO NONE OF THE SYSTEMS THAT WE
HAVE RIGHT NOW TO GET THAT MUCH

866
01:07:51,460 --> 01:07:55,730
MASS TO MARS, GET IT DOWN TO THE
SURFACE SAFELY, THEY DON'T EXIST

867
01:07:55,730 --> 01:07:57,430
RIGHT NOW.
WE ARE WORKING ON THEM AND

868
01:07:57,430 --> 01:08:03,619
DEVELOPING THEM BUT HAVE NOT
BEEN ABLE TO USE THEM YET.

869
01:08:03,619 --> 01:08:08,589
THE SYSTEMS THAT A HUMAN WOULD
NEED TO SURVIVE ON THE SURFACE

870
01:08:08,589 --> 01:08:10,430
IS SOMETHING WE HAVEN'T YET
DEVELOPED.

871
01:08:10,430 --> 01:08:15,230
IT IS UNDER CREATION RIGHT NOW.
PERHAPS MOST IMPORTANT TO ANYONE

872
01:08:15,230 --> 01:08:20,200
WHO WOULD BE ON THAT CREW, THE
SYSTEMS FOR RETURNING FROM MARS,

873
01:08:20,200 --> 01:08:25,770
BLASTING OFF FROM THE SURFACE
GETTING TO MARS ORBIT THOSE HAVE

874
01:08:25,770 --> 01:08:28,290
NOT BEEN DEVELOPED AND TESTED
AND VALIDATED.

875
01:08:28,290 --> 01:08:32,850
ALL OF THOSE ALONG WITH MANY
OTHER TECHNOLOGIES, RADIATION

876
01:08:32,850 --> 01:08:38,700
PROTECTION, NUTRITION ANALYSIS
AND TOOLS FOR MAINTAINING CREW

877
01:08:38,700 --> 01:08:42,710
HEALTH AND SPACECRAFT HEALTH,
ALL OF THOSE THINGS ARE IN

878
01:08:42,710 --> 01:08:44,970
DEVELOPMENT AND WE NEED ALL OF
THEM.

879
01:08:44,970 --> 01:08:47,940
BASICALLY WE NEED A BUNCH OF
REALLY GOOD, REALLY SMART PEOPLE

880
01:08:47,940 --> 01:08:49,790
WHO UNDERSTAND HOW TO TACKLE
THESE PROBLEMS.

881
01:08:49,790 --> 01:08:53,270
THIS IS WHY I'M LOOKING AT THE
STUDENTS IN THE ROOM RIGHT NOW

882
01:08:53,270 --> 01:08:55,030
AS WELL AS ALL OF THE ONES THAT
ARE OUT THERE.

883
01:08:55,030 --> 01:08:57,930
I WOULD LOVE TO GO TO MARS AND
FIND MY PATHFINDER ROVER

884
01:08:57,930 --> 01:08:59,411
SOMEDAY.
THAT IS NOT GOING TO HAPPEN

885
01:08:59,411 --> 01:09:02,190
WITHOUT A BUNCH OF PEOPLE MAKING
THAT JOURNEY POSSIBLE.

886
01:09:02,190 --> 01:09:10,640
THAT'S WHY WE NEED YOU GUYS.
THE WATER ISSUE, THEN.

887
01:09:10,640 --> 01:09:14,500
THE WATER ISSUE IS REALLY A
FASCINATING QUESTION BECAUSE WE

888
01:09:14,500 --> 01:09:17,180
HAVE KNOWN FOR A LONG TIME THAT
THERE WAS WATER ON MARS.

889
01:09:17,180 --> 01:09:20,500
IT'S FROZEN UP IN THE POLAR
CAPS.

890
01:09:20,500 --> 01:09:23,790
WE CAN SEE THE POLAR CAPS
EXPANDING AND RECEDING WITH THE

891
01:09:23,790 --> 01:09:27,630
SEASONS AND WE KNEW IT WAS PART
WATER ICE AND PART FROZEN CARBON

892
01:09:27,630 --> 01:09:29,870
DIOXIDE.
THE THING THAT HAS BEEN A

893
01:09:29,870 --> 01:09:37,580
SURPRISE RECENTLY IS FINDING OUT
HOW EXTENSIVE THE POTENTIAL

894
01:09:37,580 --> 01:09:41,250
RESERVOIRS OF WATER MAY BE ON
MARS TODAY.

895
01:09:41,250 --> 01:09:43,460
WE HAVE HAD MEASUREMENTS AND
OBSERVATIONS FROM VARIOUS

896
01:09:43,460 --> 01:09:50,930
DIFFERENT MARS ORBITERS THAT
HAVE GIVEN US INDICATIONS OF

897
01:09:50,930 --> 01:09:57,910
LARGE RESERVOIRS OF FROZEN WATER
NEAR THE SURFACE VOLUMES OF

898
01:09:57,910 --> 01:10:08,710
WATER THAT --
THAT WAS SORT -- WHAT WE JUST

899
01:10:08,710 --> 01:10:12,270
ANNOUNCED ON MONDAY IS NOT JUST
THE POSSIBILITY OF FROZEN WATER

900
01:10:12,270 --> 01:10:21,140
BUT ACTIVE THAT IS BASICALLY
VERY ACCESSIBLE.

901
01:10:21,140 --> 01:10:25,500
TO GET TO THAT POIRNLT THE IDEA
OF WATER BEING ACCESSIBLE AT THE

902
01:10:25,500 --> 01:10:30,960
SURFACE AND ABLE TO BE UTILIZED
BY HUMAN CREW BECOMES A GAME

903
01:10:30,960 --> 01:10:33,270
CHANGER IN TERMS OF HOW WE GET
TO MARS.

904
01:10:33,270 --> 01:10:36,230
WE NO LONGER TALK ABOUT TAKING
THE WATER.

905
01:10:36,230 --> 01:10:45,460
INSTEAD WE CAN BASICALLY FARM
WATER THAT IS THERE, PROCESS IT.

906
01:10:45,460 --> 01:10:49,170
CRACK IT AND BREAK IT DOWN TO
PROVIDE OXYGEN TO BREATHE AND

907
01:10:49,170 --> 01:10:55,080
THEN COMBINE IT WITH OTHER FORMS
AND MAKE A RETURN TRIP.

908
01:10:55,080 --> 01:10:59,250
IT REALLY CHANGES A WHOLE
SCENARIO AND ARCHITECTURE FOR

909
01:10:59,250 --> 01:11:02,020
HOW WE GET TO MARS AND GET
PEOPLE BACK.

910
01:11:02,020 --> 01:11:07,280
SO THAT IS A VERY BIG DEAL.
DON'T FORGET WATERING YOUR

911
01:11:07,280 --> 01:11:11,390
PLANTS, TOO.
ABSOLUTELY.

912
01:11:11,390 --> 01:11:15,290
DR. GREEN TALKED ABOUT IT A
LITTLE BIT JUST THE NUTRIENTS

913
01:11:15,290 --> 01:11:19,620
AND THE COMPONENTS OF THE SOIL
THAT WE ARE FINDING NOW THAT CAN

914
01:11:19,620 --> 01:11:21,750
BENEFIT WHAT YOU WANT TO-DO, AS
WELL.

915
01:11:21,750 --> 01:11:26,310
THIS WHOLE AREA OF RESOURCE
UTILIZATION THAT WE KEEP TALKING

916
01:11:26,310 --> 01:11:30,190
ABOUT, THE MORE THAT WE CAN USE
ON MARS THE LESS WE HAVE TO TAKE

917
01:11:30,190 --> 01:11:32,330
WITH US.
THAT IS ONE OF THE OTHER

918
01:11:32,330 --> 01:11:34,500
BENEFITS OF POTENTIALLY GROWING
PLANTS.

919
01:11:34,500 --> 01:11:37,290
SEEDS ARE A LOT LIGHTER TO TAKE
THAN FOOD.

920
01:11:37,290 --> 01:11:43,560
IF YOU CAN RECYCLE THINGS AND
THE HUMAN WASTE, ALL OF THE

921
01:11:43,560 --> 01:11:46,870
THINGS ARE NO LONGER WASTE.
THEY ARE RESOURCES.

922
01:11:46,870 --> 01:11:51,870
IF WE HAVE RESOURCES AVAILABLE
ON MARS, AS WELL, THEN WE ARE

923
01:11:51,870 --> 01:11:54,830
FARTHER ALONG THAN WE WOULD BE
IF WE HAD TO TAKE EVERYTHING

924
01:11:54,830 --> 01:11:57,810
WITH US.
SO USING ANY OF THE RESOURCES IS

925
01:11:57,810 --> 01:12:00,190
GOING TO BE REALLY, REALLY
VALUABLE BECAUSE IT COSTS A LOT

926
01:12:00,190 --> 01:12:04,840
TO LAUNCH EVEN A SMALL AMOUNT OF
MATERIAL TO MARS.

927
01:12:04,840 --> 01:12:09,000
SO LET'S TAKE A QUESTION FROM
ONE OF OUR STUDENTS HERE IN THE

928
01:12:09,000 --> 01:12:46,990
ROOM.
ABOUT DO ASTRONAUTS DO MENTAL

929
01:12:46,990 --> 01:12:55,560
TRAINING AND PREPARATION TO BE
AWAY FROM HOME FOR SO LONG.

930
01:12:55,560 --> 01:13:02,070
PART OF THE SELECTION PROCESS
INVOLVES THAT, AS WELL.

931
01:13:02,070 --> 01:13:05,490
WRITTEN AND INTERVIEWS THAT GO
ON.

932
01:13:05,490 --> 01:13:14,540
SO THEY ARE LOOKING AT THE WHOLE
SELECTION PROCESS.

933
01:13:14,540 --> 01:13:20,550
AND THE BULK OF OUR TRAINING
OUTSIDE OF LEARNING ABOUT THE

934
01:13:20,550 --> 01:13:24,070
SYSTEMS AND THE SCIENTIFIC
ASPECTS OF THE PAY LOADS AND

935
01:13:24,070 --> 01:13:28,380
RESEARCH THAT ARE GOING ON IS
REALLY TEAM BUILDING, WHAT WE

936
01:13:28,380 --> 01:13:31,790
CALL EXPEDITIONARY TYPE
TRAINING.

937
01:13:31,790 --> 01:13:34,630
THAT CAN BE FROM GOING AND
LIVING FOR A COUPLE WEEKS UNDER

938
01:13:34,630 --> 01:13:40,750
WATER IN A HABITAT SIMILAR TO
SPACE ON A SPACE STATION OR ON

939
01:13:40,750 --> 01:13:44,440
THE SURFACE OF A PLANET
SOMEWHERE TO HIKING IN THE

940
01:13:44,440 --> 01:13:48,910
CANYON LANDS OF UTAH FOR TEN
DAYS WITH JUST THE SIX PEOPLE IN

941
01:13:48,910 --> 01:13:52,730
YOUR CREW AND NOT SEEING ANYBODY
FOR THAT ENTIRE TIME.

942
01:13:52,730 --> 01:13:56,870
A BIG PART OF THAT IS YOU LEARN
HOW YOU WORK TOGETHER AS A CREW

943
01:13:56,870 --> 01:14:00,040
BUT YOU LEARN A LOT ABOUT
YOURSELF.

944
01:14:00,040 --> 01:14:05,980
THIS KIND OF SELF AWARENESS THAT
I THINK YOU REALLY HAVE TO HAVE

945
01:14:05,980 --> 01:14:08,260
IN ORDER TO UNDERSTAND WHAT YOUR
OWN STRENGTHS AND WEAKNESSES

946
01:14:08,260 --> 01:14:12,550
ARE, WHAT THOSE OF YOUR CREW ARE
SO THAT YOU CAN WORK BEST AS A

947
01:14:12,550 --> 01:14:14,450
TEAM.
AND THEN WHEN YOU ARE ON YOUR

948
01:14:14,450 --> 01:14:19,560
OWN I CAN TELL YOU WHEN YOU ARE
OUT ON A SPACE WALK AND YOU ARE

949
01:14:19,560 --> 01:14:22,870
IN YOUR OWN LITTLE SPACESHIP
CRAWLING AROUND THE SPACE

950
01:14:22,870 --> 01:14:26,040
STATION YOU HAVE TO UNDERSTAND
THOSE KINDS OF THINGS ABOUT

951
01:14:26,040 --> 01:14:29,290
YOURSELF AND HOW YOU ARE GOING
TO DEAL WITH SOMETHING IF THINGS

952
01:14:29,290 --> 01:14:33,480
DON'T GO AS PLANNED.
I THINK WE DO A REALLY GOOD JOB

953
01:14:33,480 --> 01:14:38,280
OF KIND OF SUBTLY INCORPORATING
THAT INTO THE BULK OF OUR

954
01:14:38,280 --> 01:14:41,380
TRAINING.
I KNOW NOW THERE IS A LOT OF

955
01:14:41,380 --> 01:14:46,520
STUDIES GOING ON WHERE WE ARE
POLLING OURSELVES WITH QUESTIONS

956
01:14:46,520 --> 01:14:50,330
FROM OUR BEHAVIORAL SCIENCE
FOLKS ON IF YOU ARE ON THIS KIND

957
01:14:50,330 --> 01:14:54,300
OF CLASS EMISSION GOING THIS
LONG, THIS FAR BASED ON YOUR

958
01:14:54,300 --> 01:14:57,860
EXPERIENCE ON THE SPACE STATION
OR THE SPACE SHUTTLE WHAT DO YOU

959
01:14:57,860 --> 01:15:05,010
THINK YOU WOULD NEED THINGS LIKE
GROWING FRESH FOOD AND HAVING

960
01:15:05,010 --> 01:15:08,910
PLANTS AROUND YOU, VISUAL
REFERENCES THAT YOU LOSE IF YOU

961
01:15:08,910 --> 01:15:12,260
GO FARTHER FROM EARTH.
THOSE KINDS OF THINGS, HOW DO

962
01:15:12,260 --> 01:15:14,930
YOU SUPPLEMENT IT AND
COMMUNICATE WITH YOUR FAMILY AND

963
01:15:14,930 --> 01:15:17,510
FRIENDS.
IT'S A BIG DEAL.

964
01:15:17,510 --> 01:15:21,280
AND IT'S REALLY NEAT TO SEE THE
EVOLUTION OF HOW WE DEVELOP

965
01:15:21,280 --> 01:15:26,380
PLANS FOR INCORPORATING THOSE
THINGS INTO A MISSION.

966
01:15:26,380 --> 01:15:32,330
LET'S GO TO ONE OF OUR
QUESTIONS FROM THE DLN.

967
01:15:32,330 --> 01:15:36,580
ON BEHALF OF THE STUDENTS WE
WANT TO KNOW WHAT DO WE HOPE TO

968
01:15:36,580 --> 01:15:40,400
GAIN FROM OUR EXPLORATIONS TO
MARS?

969
01:15:40,400 --> 01:15:51,020
WHAT DO WE HOPE TO DPAN FROM
OUR EXPLORATION TO MARS?

970
01:15:51,020 --> 01:15:54,690
I THINK PROBABLY THE THING WE
HOPE TO GAIN THE MOST IS THE

971
01:15:54,690 --> 01:15:58,810
THING WE DON'T KNOW HOW TO ASK
ABOUT.

972
01:15:58,810 --> 01:16:02,560
IT'S THE STUFF THAT WE DON'T
KNOW IS THERE THAT IS PROBABLY

973
01:16:02,560 --> 01:16:05,430
GOING TO BE THE MOST AMAZING,
MOST VALUABLE AND MOST

974
01:16:05,430 --> 01:16:08,560
INTERESTING THAT WE WILL FIND
OUT ABOUT MARS.

975
01:16:08,560 --> 01:16:12,830
JIM GREEN TALKED EARLIER ABOUT
THE IDEA THAT HAVING MARS AS

976
01:16:12,830 --> 01:16:17,950
BEGINNING OF EARTH 2.0 AS OUR
ABILITY TO BACK UP THE SPECIES

977
01:16:17,950 --> 01:16:21,770
IS A HUGE THING.
WE ARE GOING TO DISCOVER STUFF

978
01:16:21,770 --> 01:16:28,060
WHEN WE GET TO MARS, THINGS
ROBOTIC SYSTEMS MAY NOT TELL US

979
01:16:28,060 --> 01:16:33,060
THAT ARE GOING TO SURPRISE US
AND WE WILL GO HOW DID WE NOT

980
01:16:33,060 --> 01:16:36,101
SEE THIS COMING.
OF COURSE, THOSE ARE GREAT AND

981
01:16:36,101 --> 01:16:39,190
WONDERFUL DISCOVERIES.
SO I THINK THOSE ARE THE ONES

982
01:16:39,190 --> 01:16:42,710
THAT WILL BE MOST VALUABLE AND
MOST INTERESTING TO US.

983
01:16:42,710 --> 01:16:47,760
I THINK WE CAN'T DISCOUNT ALL
OF THE THINGS WE WILL DISCOVER

984
01:16:47,760 --> 01:16:52,510
ALONG THE WAY AS WE LEARN TO
LIVE TO GET TO MARS.

985
01:16:52,510 --> 01:16:57,020
A LOT OF THE THINGS THAT WE HAVE
DEVELOPED NOW TO LEARN TO LIVE

986
01:16:57,020 --> 01:17:00,750
IN LOW EARTH ORBIT HAVE HAD A
LOT OF EARTH-BASED BENEFITS, AS

987
01:17:00,750 --> 01:17:04,700
WELL.
I THINK THAT'S JUST GOING TO BE

988
01:17:04,700 --> 01:17:07,210
ACCELERATED AS WE PROCEED
TOWARDS MARS.

989
01:17:07,210 --> 01:17:11,680
SO ALL OF THE THINGS WILL IMPACT
EVERYONE ON EARTH.

990
01:17:11,680 --> 01:17:16,610
TO TALK TO DR. GREEN'S POINT
EARLIER ABOUT BACKUP PLANET FOR

991
01:17:16,610 --> 01:17:20,660
HUMANITY YOU CAN THINK OF IT AS
A BACKUP PLANET FOR ALL LIFE ON

992
01:17:20,660 --> 01:17:24,110
EARTH.
WE ARE THE ONLY SPECIES ON THIS

993
01:17:24,110 --> 01:17:27,830
PLANET THAT IS SPACE FAIRING AT
THE MOMENT.

994
01:17:27,830 --> 01:17:32,180
LIFE ON EARTH HAS EVOLVED AND IS
COMPLEX AND WONDERFUL.

995
01:17:32,180 --> 01:17:35,700
AND SO WE ARE KIND OF EVERYBODY
ELSE'S ONLY HOPE, AS WELL.

996
01:17:35,700 --> 01:17:39,880
ALL THE ANIMALS AND PLANTS.
THINK OF IT THAT WAY, AS WELL.

997
01:17:39,880 --> 01:17:43,790
PRETTY IMPORTANT STUFF.
WILL MODIFY THAT AND POINT

998
01:17:43,790 --> 01:17:49,400
OUT THAT RIGHT NOW MARS IS
CURRENTLY THE ONLY PLANET IN THE

999
01:17:49,400 --> 01:17:52,570
UNIVERSE POPULATED SOLELY BY
ROBOTS.

1000
01:17:52,570 --> 01:17:58,560
KIND OF COOL.
> WE HAVE ANOTHER DLN

1001
01:17:58,560 --> 01:18:00,270
QUESTION.
SO LET'S GO TO OUR QUESTION ON

1002
01:18:00,270 --> 01:18:03,710
THE DLN.
HI.

1003
01:18:03,710 --> 01:18:06,580
WE ARE FROM GRIMSLY HIGH SCHOOL
IN NORTH CAROLINA.

1004
01:18:06,580 --> 01:18:13,000
OUR QUESTION IS, I READ THAT ON
THE TRIP TO MARS THE SPACESHIP

1005
01:18:13,000 --> 01:18:18,290
WOULD BE SUBJECTED TO LOTS OF
RADIATION WHICH IS A LOT MORE

1006
01:18:18,290 --> 01:18:20,730
THAN NORMAL.
WE ARE WONDERING HOW DO YOU

1007
01:18:20,730 --> 01:18:34,790
COMBAT THAT?
ONE OF THE THINGS WE ARE WORKING

1008
01:18:34,790 --> 01:18:40,400
ON NOW IS RADIATION PROTECTION
SYSTEMS.

1009
01:18:40,400 --> 01:18:42,990
THROW A COUPLE OF NUMBERS AT
YOU.

1010
01:18:42,990 --> 01:18:45,890
ONE OF THE THINGS WE HAVE DONE
IN OUR ANALYSIS AND USING SOME

1011
01:18:45,890 --> 01:18:52,680
OF THE MEASUREMENTS FROM THE
CURIOSITY ROVER IS TO LOOK AT

1012
01:18:52,680 --> 01:18:56,230
THE RADIATION LEVELS THAT THE
SPACECRAFT IS EXPOSED TO DURING

1013
01:18:56,230 --> 01:19:01,190
CRUISE FROM EARTH TO MARS.
AND USING THE MEASUREMENTS WE

1014
01:19:01,190 --> 01:19:03,660
HAVE BEEN ABLE TO DETERMINE THAT
FOR WHAT WE ESTIMATE TO BE A

1015
01:19:03,660 --> 01:19:08,300
TYPICAL 500 DAY MISSION FROM
EARTH TO MARS AND THEN BACK TO

1016
01:19:08,300 --> 01:19:16,850
EARTH YOU WOULD GET A TOTAL DOSE
OF JUST OVER 1.01 C AND THAT IS

1017
01:19:16,850 --> 01:19:22,200
HIGHER THAN THE TYPICAL LEVEL
THAT YOU WOULD GET AS A HUMAN ON

1018
01:19:22,200 --> 01:19:26,410
EARTH UNDER THE PROTECTION OF
THE EARTH ATMOSPHERE.

1019
01:19:26,410 --> 01:19:30,750
WHAT THAT TRANSLATES INTO IS AN
ESTIMATED LIFETIME PROBABILITY

1020
01:19:30,750 --> 01:19:35,950
OF ABOUT AN INCREASE OF ABOUT 5%
OF CONTRACTING FATAL CANCER.

1021
01:19:35,950 --> 01:19:39,400
THAT IS A FAIRLY SIGNIFICANT
INCREASE IN RADIATION DOSE THAT

1022
01:19:39,400 --> 01:19:41,340
THE ASTRONAUTS WOULD BE EXPOSED
TO.

1023
01:19:41,340 --> 01:19:44,420
TO COUNTER ACT THAT WE ARE
LOOKING AT TECHNOLOGIES FOR HOW

1024
01:19:44,420 --> 01:19:48,870
TO PROTECT HUMANS DURING A
TRANSIT FROM EARTH TO MARS AND

1025
01:19:48,870 --> 01:19:52,520
BACK TO EARTH WHICH IS WHEN MOST
OF IT IS ABSORBED AS WELL AS

1026
01:19:52,520 --> 01:19:55,532
DOWN ON THE MARS SURFACE ITSELF
AND THERE ARE DIFFERENT SORTS OF

1027
01:19:55,532 --> 01:19:59,550
SHIELDING TECHNOLOGIES WE ARE
TAKING A LOOK AT AS WELL AS

1028
01:19:59,550 --> 01:20:02,080
ULTIMATELY IN THE LONG TERM
SEEING IF THERE MIGHT BE THINGS

1029
01:20:02,080 --> 01:20:05,780
TO DO TO THE ASTRONAUTS
THEMSELVES TO BE ABLE TO BETTER

1030
01:20:05,780 --> 01:20:09,720
CONP TEBD WITH ABSORBED
RADIATION.

1031
01:20:09,720 --> 01:20:11,910
WE DON'T HAVE THE ULTIMATE
ANSWER YET.

1032
01:20:11,910 --> 01:20:15,220
WE ARE WORKING ON IT RIGHT NOW
BUT IS ONE OF THE TOPICS OF

1033
01:20:15,220 --> 01:20:18,850
INTEREST.
LET'S GO TO A QUESTION HERE

1034
01:20:18,850 --> 01:20:22,250
IN THE ROOM.
WE HAVE A QUESTION RIGHT HERE.

1035
01:20:22,250 --> 01:20:34,620
HOW WOULD WE EXPECT WATER
FROM POLAR ICE CAPS?

1036
01:20:34,620 --> 01:20:48,210
I'M INACTIVE.
IN THE MOVIE YOU KNEW.

1037
01:20:48,210 --> 01:20:54,430
I COULD HAVE TOLD YOU THEN.
WHAT YOU ARE LOOKING AT IS THE

1038
01:20:54,430 --> 01:20:58,280
ULTIMATE BIG WATER PURIFICATION
SYSTEM.

1039
01:20:58,280 --> 01:21:03,520
ONE OF THE THINGS WITH RECENT
ANNOUNCEMENT ON MONDAY OF HAVING

1040
01:21:03,520 --> 01:21:08,400
POTENTIALLY LIQUID WATER ALL
OVER THE PLANET AND NOT JUST IS

1041
01:21:08,400 --> 01:21:13,560
ONE OF THE THINGS THAT SAYS WE
DOEPT HAVE TO GO TO THE POLLS TO

1042
01:21:13,560 --> 01:21:20,900
GET TO WATER RESOURCES.
WHAT YOU HAVE THERE AND WHAT

1043
01:21:20,900 --> 01:21:25,610
WE -- WHAT ARE DESCRIBING AS
WATER IS BASICALLY A THICK,

1044
01:21:25,610 --> 01:21:32,770
EXTREMELY SALTY BRIEM.
THERE IS A DIFFERENT PROCESS TO

1045
01:21:32,770 --> 01:21:37,150
USE SORT OF FROZEN MUD YOU MELT
IT AND GET THE LIQUID.

1046
01:21:37,150 --> 01:21:42,580
FROM THAT YOU CAN DISTILL IT AND
PURIFY IT, FILTRATION PROCESS.

1047
01:21:42,580 --> 01:21:45,300
THOSE TECHNIQUES ARE ACTUALLY
PRETTY WELL UNDERSTOOD FOR BEING

1048
01:21:45,300 --> 01:21:48,320
ABLE TO EXTRACT THE WATER.
IF YOU REALLY WANTED TO GET

1049
01:21:48,320 --> 01:21:56,840
SPORTY ABOUT THINGS THERE IS A
DRAMATIC CHEMICAL PROCESS THAT

1050
01:21:56,840 --> 01:21:58,960
CAN TAKE PLACE IF YOU ARE
WILLING TO INSERT ENOUGH ENERGY

1051
01:21:58,960 --> 01:22:06,640
AND CONTROL HOW IT IS EXTRACTED
TO CONVERT HYDROGEN INTO

1052
01:22:06,640 --> 01:22:09,980
DRINKABLE WATER.
IT'S NOT A RECOMMENDED PRACTICE

1053
01:22:09,980 --> 01:22:14,060
BUT IT DOES WORK.
LET'S GO TO A QUESTION FROM

1054
01:22:14,060 --> 01:22:19,020
SOCIAL MEDIA.
THIS IS A QUESTION FOR

1055
01:22:19,020 --> 01:22:23,540
NICOLE.
THIS IS FROM EMILY MARTINEZ.

1056
01:22:23,540 --> 01:22:30,010
DO NASA ASTRONAUTS BRING DUCT
TAPE TO SPACE?

1057
01:22:30,010 --> 01:22:36,580
YES.
IT IS ONE OF THE STAPLES UP

1058
01:22:36,580 --> 01:22:42,250
THERE FOR ALL KINDS OF THINGS.
AND I THINK IT KIND OF SPEAKS TO

1059
01:22:42,250 --> 01:22:45,960
THE PHILOSOPHY OF KEEPING IT
SIMPLE.

1060
01:22:45,960 --> 01:22:50,390
I THINK THERE IS A LOT OF PLACES
WHERE WE CAN THINK ABOUT VERY

1061
01:22:50,390 --> 01:22:54,170
COMPLEX WAYS TO DO THINGS AND
THE SIMPLEST WAY IS USUALLY THE

1062
01:22:54,170 --> 01:22:56,790
BETTER WAY.
AND DUCT TAPE IS ONE OF THOSE

1063
01:22:56,790 --> 01:23:00,500
REALLY BRILLIANT EXAMPLES OF
THAT.

1064
01:23:00,500 --> 01:23:06,980
DR. HOLLAND WHO IS ONE OF OUR
DLNs FROM LINCOLN JUNIOR HIGH,

1065
01:23:06,980 --> 01:23:11,810
ONE OF THE TEACHERS.
WHAT WAS THE MOST DIFFICULT PART

1066
01:23:11,810 --> 01:23:15,980
ABOUT MAKING THE MOVIE LOOK
REALISTIC ON YOUR END?

1067
01:23:15,980 --> 01:23:19,180
I DON'T THINK IT WAS HARD.
A LOT OF THE WORK HAD BEEN DONE

1068
01:23:19,180 --> 01:23:24,400
BEFORE IN TERMS OF OBVIOUSLY
ANDY WEIR'S BRILLIANT BOOK AND

1069
01:23:24,400 --> 01:23:29,460
THE GREAT SCRIPT.
I THINK WHAT THEY WERE ABLE

1070
01:23:29,460 --> 01:23:34,020
TO-DO IS COMBINE THE IDEAS OF
SCIENCE FICTION AND SCIENCE

1071
01:23:34,020 --> 01:23:37,750
FACT.
SO IT ALMOST FELT SEAMLESS.

1072
01:23:37,750 --> 01:23:40,330
LIKE I WAS SAYING BEFORE A LOT
OF TIME I SPENT JUST WITH THE

1073
01:23:40,330 --> 01:23:44,560
WICKAPEDIA PAGE OPEN AND CROSS
REFERENCING THINGS AND TRYING TO

1074
01:23:44,560 --> 01:23:49,140
UNDERSTAND WHAT THE SCIENCE
FICTION PARTS WERE AND BEING

1075
01:23:49,140 --> 01:23:53,870
ABLE TO LOOK AT THE LOCATION OF
PATHFINDER AND ITS CAPABILITIES

1076
01:23:53,870 --> 01:23:56,690
AND SEE WHAT THE DIFFERENCES
WERE WITH THE PATHFINDER THAT WE

1077
01:23:56,690 --> 01:24:00,230
HAD AND THE ONE THAT IS ACTUALLY
UP THERE.

1078
01:24:00,230 --> 01:24:02,390
SO THAT WAS VERY EXCITING
UNDERSTANDING THE DEPTH OF

1079
01:24:02,390 --> 01:24:08,160
RESEARCH TAKEN ALREADY.
SO I WAS VERY -- I WAS SORT OF

1080
01:24:08,160 --> 01:24:10,790
THRILLED TO COME ON BOARD WITH
SOMETHING ESPECIALLY WITH RIDLEY

1081
01:24:10,790 --> 01:24:16,980
SCOTT WHO HAS SUCH AN IN DEPTH
UNDERSTANDING AND IS ABLE TO

1082
01:24:16,980 --> 01:24:20,310
COMBINE THAT WITH THIS REALLY
SORT OF EXTRAORDINARY CREATIVE

1083
01:24:20,310 --> 01:24:25,100
IMAGINATION.
A LOT OF THAT WAS PREPARED SO

1084
01:24:25,100 --> 01:24:34,480
YOU COULD CONCENTRATE ON ACTING
WHICH IS GREAT.

1085
01:24:34,480 --> 01:24:35,740
YOU SAID A LITTLE BIT
EARLIER.

1086
01:24:35,740 --> 01:24:40,960
I WOULD LIKE TO SAY THAT I HAVE
BEEN ON I THINK TWO DAYS NOW OF

1087
01:24:40,960 --> 01:24:46,010
THIS TRIP GOING ALONG WITH THE
MOVIE AND SHARING BOTH KIND OF

1088
01:24:46,010 --> 01:24:52,350
THE SCIENCE SIDE AND THE MOVIE
SIDE OF THIS WHOLE THING.

1089
01:24:52,350 --> 01:24:56,930
I JUST WANT TO SAY THANK YOU
BECAUSE FROM RIDLEY SCOTT TO

1090
01:24:56,930 --> 01:25:00,620
ANDY AND THE FOLKS WHO PUT
TOGETHER THE STORY IT HAS BEEN

1091
01:25:00,620 --> 01:25:05,930
REALLY IMPRESSIVE TO ME TO SPEND
TIME WITH SEBASTIAN AND McKENZIE

1092
01:25:05,930 --> 01:25:10,770
AND MEETING YOU AND TO SEE
THE -- I MEAN, I THENG REALLY

1093
01:25:10,770 --> 01:25:15,190
THE DEEP DOWN HEART FELT
ENTHUSIASM FOR WHAT THE BASIS OF

1094
01:25:15,190 --> 01:25:22,520
THE STORY IS AND TO ALLOW US AND
I SAY US AS NASA TO COMMUNICATE

1095
01:25:22,520 --> 01:25:27,120
TO AUDIENCES THAT MIGHT NOT EVER
THINK ABOUT SPACE IN THEIR DAY

1096
01:25:27,120 --> 01:25:31,580
TO DAY ROUTINE.
AND I THINK WE NEED TO DO MORE

1097
01:25:31,580 --> 01:25:39,790
OF THAT, PRESENTING THE SCIENCE
FACT STUFF MIXED WITH

1098
01:25:39,790 --> 01:25:43,190
INTERESTING STORIES TO ENGAGE
THE PUBLIC AND TO HELP THEM

1099
01:25:43,190 --> 01:25:46,460
RECOGNIZE THE WONDERFUL THINGS
WE ARE DOING IN SPACE RIGHT NOW

1100
01:25:46,460 --> 01:25:50,430
ON THE STATION, WITH OUR ROBOTIC
EXPLORATION AND WHAT WE HAVE TO

1101
01:25:50,430 --> 01:25:53,910
LOOK FORWARD TO IN THE JOURNEY
TO MARS.

1102
01:25:53,910 --> 01:26:01,880
THANK YOU VERY MUCH.
[APPLAUSE]

1103
01:26:01,880 --> 01:26:04,050
BELIEVE IT OR NOT WE ARE
ALMOST OUT OF TIME.

1104
01:26:04,050 --> 01:26:21,210
LET'S GO TO ONE LAST QUESTION ON
THE DLN.

1105
01:26:21,210 --> 01:26:36,810
[INAUDIBLE].
SO THERE IS STILL AN

1106
01:26:36,810 --> 01:26:39,320
ATMOSPHERE.
IT'S JUST THIN.

1107
01:26:39,320 --> 01:26:43,440
THERE IS STILL WIND THAT CAN
MOVE AROUND DUST.

1108
01:26:43,440 --> 01:26:48,710
IT'S NOT SOMETHING THAT -- IT'S
ENOUGH OF AN ATMOSPHERE THAT WE

1109
01:26:48,710 --> 01:26:52,410
HAVE TO WORRY ABOUT BUT NOT
ENOUGH THAT WE CAN DO A WHOLE

1110
01:26:52,410 --> 01:26:55,480
LOT WITH.
BESIDES THE CHEMICAL PROCESSING

1111
01:26:55,480 --> 01:26:59,230
TYPE THING.
SO SIMILAR TO HOW WE CAN KICK UP

1112
01:26:59,230 --> 01:27:03,500
DUST HERE ON EARTH WE CAN ALSO
KICK UP DUST IN THE MARTIAN

1113
01:27:03,500 --> 01:27:06,830
ATMOSPHERE.
HOW DOES THE DUST COMPARE

1114
01:27:06,830 --> 01:27:09,830
BETWEEN EARTH DUST AND MARS
DUST?

1115
01:27:09,830 --> 01:27:13,540
SO THERE ARE SOME
DIFFERENCES.

1116
01:27:13,540 --> 01:27:18,640
FOR ONE, I'M TOLD BY THE MEDICAL
TEAM AND BY SOME CHEMISTS THAT

1117
01:27:18,640 --> 01:27:22,020
IT IS A BIT TOXIC SO YOU
PROBABLY DON'T WANT TO BE AROUND

1118
01:27:22,020 --> 01:27:26,840
IT WHICH IS ANOTHER ONE OF THE
REASONS WHY DUST MITIGATION

1119
01:27:26,840 --> 01:27:33,900
TECHNOLOGY IS SO IMPORTANT.
WHEN WE LOOK AT OTHER PLACES SO

1120
01:27:33,900 --> 01:27:38,760
IF WE LOOK AT FOR EXAMPLE THE
MOON, THERE ARE JAING

1121
01:27:38,760 --> 01:27:41,320
UDPARTICLES BOUGHT WE DON'T HAVE
AN ATMOSPHERE TO KICK AROUND THE

1122
01:27:41,320 --> 01:27:46,670
DUST.
THERE IS SOME OF THAT ON MARS,

1123
01:27:46,670 --> 01:27:49,030
AS WELL.
SO THERE IS DIFFERENT MECHANICS

1124
01:27:49,030 --> 01:27:53,470
AND DIFFERENT CHEMICAL MAKEUP
AND WE ARE LEFT TO FIGURE OUT

1125
01:27:53,470 --> 01:27:57,190
WHAT TO DO WITH IT.
HOW DO WE EXPLOIT IT FOR OUR

1126
01:27:57,190 --> 01:28:02,760
EXPLORATION PURPOSES AND KEEP
AWAY FROM THE NASTY PART OF IT.

1127
01:28:02,760 --> 01:28:10,420
IS THE WIND HELPFUL FOR
ENERGY PRODUCTION?

1128
01:28:10,420 --> 01:28:17,020
MAYBE IF IT WAS THE RIGHT
SYSTEM.

1129
01:28:17,020 --> 01:28:19,140
BUT IT'S A PRETTY THIN
ATMOSPHERE.

1130
01:28:19,140 --> 01:28:23,280
ALL RIGHT.
I JUST WANT TO SAY THANK YOU TO

1131
01:28:23,280 --> 01:28:27,310
OUR AWESOME PANEL UP HERE AND
THANK YOU TO ALL OF OUR SPEAKERS

1132
01:28:27,310 --> 01:28:32,190
TODAY AND TO ALL OF YO AAND ALL
OF OUR STUDENTS ON THE DLN AND

1133
01:28:32,190 --> 01:28:35,410
EVERYONE WHO WATCHED US ON NASA
TV FOR PARTICIPATING AND SENDING

1134
01:28:35,410 --> 01:28:37,970
IN YOUR QUESTIONS TODAY.
I HOPE YOU WILL CONTINUE TO

1135
01:28:37,970 --> 01:28:41,780
FOLLOW ALONG WITH NASA.
YOU CAN LEARN MORE ON THE

1136
01:28:41,780 --> 01:28:44,641
JOURNEY TO MARS BY VISITING
NASA.GOV.