



1
00:00:03,689 --> 00:00:04,689
>>> GOOD AFTERNOON.

2
00:00:04,689 --> 00:00:07,180
I'M JOHN YEMBRICK.

3
00:00:07,180 --> 00:00:10,769
WELCOME TO THE SCIENCE RESEARCH
AND TECHNOLOGY BRIEFING FOR THE

4
00:00:10,769 --> 00:00:12,269
INTERNATIONAL SPACE STATION.

5
00:00:12,269 --> 00:00:16,119
WE'LL BE TALKING ABOUT SOME OF
THE CARGO LAUNCHING TO THE

6
00:00:16,119 --> 00:00:20,390
INTERNATIONAL SPACE STATION
ABOARD SpaceX RESUPPLY MISSION.

7
00:00:20,390 --> 00:00:24,210
THE LAUNCH IS SUNDAY AT 10:21
A.M.

8
00:00:24,210 --> 00:00:25,210
EASTERN TIME.

9
00:00:25,210 --> 00:00:27,990
AND WE BROADCAST LIVE ON NASA
TELEVISION.

10
00:00:27,990 --> 00:00:31,020
FOR THOSE WATCHING AT HOME AND
FOR THOSE WATCHING ON NASA

11
00:00:31,020 --> 00:00:35,760
TELEVISION AND ON THE WEB, YOU
CAN FOLLOW US AND ASK QUESTIONS

12

00:00:35,760 --> 00:00:41,019

USING THE #ASKNASA.

13

00:00:41,019 --> 00:00:45,469

OUR PANELISTS GOING FROM LEFT TO
RIGHT IS JULIE ROBINSON, SHE'S

14

00:00:45,469 --> 00:00:48,570

THE CHIEF SCIENTIST FOR THE
INTERNATIONAL SPACE STATION.

15

00:00:48,570 --> 00:00:56,760

AND MICHAEL STENGER, THE FLUID
INVESTIGATOR.

16

00:00:56,760 --> 00:01:04,199

AND ALESSANDRO GRATTONI, HOUSTON
METHODIST RESEARCH INSTITUTE.

17

00:01:04,199 --> 00:01:08,860

WE'LL START WITH JULIE AND THEN
WE'LL TAKE YOUR QUESTIONS.

18

00:01:08,860 --> 00:01:10,540

>> THANKS A LOT.

19

00:01:10,540 --> 00:01:13,390

IT'S GREAT TO BE HERE AHEAD OF
SpaceX LAUNCH.

20

00:01:13,390 --> 00:01:17,690

OUR SEVENTH CAN CARGO.

21

00:01:17,690 --> 00:01:20,570

AND TELL YOU A LITTLE BIT ABOUT
THE RESEARCH THAT IS GOING ON

22

00:01:20,570 --> 00:01:23,530

AND SUPPORTED BY THE FLIGHT.

23
00:01:23,530 --> 00:01:27,180
THERE ARE ABOUT 35 DIFFERENT
EXPERIMENTS THAT ARE GOING UP OR

24
00:01:27,180 --> 00:01:31,840
DOWN ON SpaceX 7 AND THOSE
SUPPORT THE OVER 250 ACTIVE

25
00:01:31,840 --> 00:01:36,030
INVESTIGATIONS WE HAVE GOING ON
IN ISS RIGHT NOW, ABOUT 700

26
00:01:36,030 --> 00:01:39,700
KILOGRAMS OF MASS UP AND ABOUT
400 OR MORE KILOGRAMS COMING

27
00:01:39,700 --> 00:01:41,520
BACK DOWN WITH SAMPLES AND SO
FORTH.

28
00:01:41,520 --> 00:01:46,850
I'M NOT GOING TO TELL YOU ABOUT
300 INVESTIGATIONS, I WON'T TELL

29
00:01:46,850 --> 00:01:49,050
BUT 35 INVESTIGATIONS EITHER.

30
00:01:49,050 --> 00:01:51,890
BUT I DID PICK A FEW OF MY
FAVORITES JUST TO GIVE AND YOU

31
00:01:51,890 --> 00:01:54,350
SENSE OF THE BREADTH AND
DIFFERENT KINDS OF DISCIPLINES

32
00:01:54,350 --> 00:01:56,680
AND REALLY INNOVATIVE THINGS
THAT ARE GOING ON ON THE SPACE

33
00:01:56,680 --> 00:01:57,750
STATION.

34
00:01:57,750 --> 00:01:59,700
WE DO HAVE A NEW FACILITY GOING
UP.

35
00:01:59,700 --> 00:02:02,410
THIS FACILITY IS CALLED WET LAB.

36
00:02:02,410 --> 00:02:06,180
IT IS A PIECE OF HARDWARE THAT
WILL LET US TO ON ORBIT GENE

37
00:02:06,180 --> 00:02:07,180
EXPRESSIONS.

38
00:02:07,180 --> 00:02:12,000
SO WE CAN UNDERSTAND FROM ANY
LIVING ORGANISM WHAT KINDS OF

39
00:02:12,000 --> 00:02:13,510
GENES ARE BEING TURNED ON AND
OFF.

40
00:02:13,510 --> 00:02:20,230
IT'S A CHAIN REACTION MACHINE
AND THAT WILL ENABLE A LOT OF

41
00:02:20,230 --> 00:02:23,670
ADDITIONAL WORK IN GENETICS AND
UNDERSTANDING THE MECHANISMS OF

42
00:02:23,670 --> 00:02:25,910
THE EFFECT OF SPACE FLIGHT ON
ORGANISMS.

43
00:02:25,910 --> 00:02:29,120

AND A COMPLETELY DIFFERENT
REALM, ANOTHER INSTRUMENT GOING

44

00:02:29,120 --> 00:02:32,700
UP IS CALLED METEOR AND THIS
INSTRUMENT WAS AN INSTRUMENT

45

00:02:32,700 --> 00:02:36,210
THAT HAD ORIGINALLY BEEN
MANIFESTED ON THE ORP 3 LUNCH

46

00:02:36,210 --> 00:02:40,920
THAT FAILED AND WAS DAMAGED AND
THEN WE HAVE A NEW REPLACEMENT

47

00:02:40,920 --> 00:02:43,160
INSTRUMENT GOING UP ON THIS
FLIGHT.

48

00:02:43,160 --> 00:02:45,381
METEOR WILL BE MOUNTED IN THE
SPACE STATION AND IT'S A

49

00:02:45,381 --> 00:02:49,900
SPECIALLY DESIGNED CAMERA TUNED
TO LOOK AT SPECIFIC WAVE LENGTHS

50

00:02:49,900 --> 00:02:53,750
OF LIGHT SO THAT IT CAN TELL US
THE CHEMICAL COMPOSITION OF

51

00:02:53,750 --> 00:02:56,959
DIFFERENT METEORS AS THEY
RE-ENTER THE EARTH'S ATMOSPHERE.

52

00:02:56,959 --> 00:03:01,319
IT CAN SEE SIGNALS FROM IRON,
CALCIUM, MAGNESIUM AND SODIUM

53

00:03:01,319 --> 00:03:06,410

AND THAT WILL HELP ASTRONOMERS
TO STUDY THE METEORS.

54
00:03:06,410 --> 00:03:10,060
ON EARTH, YOU HAVE THE WHOLE
ATMOSPHERE TO GET IN THE WAY, SO

55
00:03:10,060 --> 00:03:14,780
ITS THIS IS A GREAT OPPORTUNITY
FOR SCIENTISTS.

56
00:03:14,780 --> 00:03:18,940
ANOTHER EXPERIMENT THAT WILL BE
GOING ON IS VEGGIE 3.

57
00:03:18,940 --> 00:03:21,050
THIS IS ACTUALLY OUR SECOND
EXPERIMENT EVEN THOUGH IT'S

58
00:03:21,050 --> 00:03:22,510
NUMBERED THREE.

59
00:03:22,510 --> 00:03:23,510
GROWING PLANTS.

60
00:03:23,510 --> 00:03:26,270
>> IN A GREEN HOUSE.

61
00:03:26,270 --> 00:03:36,760
WE FLEW A SPECIAL ROMAINE
LETTUCE ON THE FIRST FLIGHT.

62
00:03:36,760 --> 00:03:40,880
IT DID A GOOD JOB PASSING THOSE
TESTS AND NOW WE'RE FLYING A

63
00:03:40,880 --> 00:03:46,660
KIND OF CABBAGE.

64

00:03:46,660 --> 00:03:49,400
WE'RE QUITE HOPEFUL THAT THE
CREW WILL GET TO EAT THE CABBAGE

65
00:03:49,400 --> 00:03:53,120
AFTER THEY GROW IT ON ISS.

66
00:03:53,120 --> 00:03:56,480
ALSO IN STUDYING THE INTERACTION
BETWEEN THE CREW AND LIVING

67
00:03:56,480 --> 00:03:59,910
ORGANISMS, WE HAVE AN
INVESTIGATION CALLED MICROBIAL

68
00:03:59,910 --> 00:04:01,120
TRACKING.

69
00:04:01,120 --> 00:04:05,069
THIS INVESTIGATION IS LOOKING AT
THE SURFACES OF EARTH SUCH AS

70
00:04:05,069 --> 00:04:07,930
THIS SURFACE YOU SEE WHICH IS
THE GALLEY TABLE SURFACE WHERE

71
00:04:07,930 --> 00:04:12,840
CREW MEMBERS EAT AND THOSE
SURFACES CAN BECOME CONTAMINATED

72
00:04:12,840 --> 00:04:15,150
WITH DIFFERENT KINDS OF
BACTERIA.

73
00:04:15,150 --> 00:04:17,910
MICROBIAL TRAFFICKING IS LOOKING
AT ALL THE DIFFERENT WAYS THE

74
00:04:17,910 --> 00:04:21,109
BACTERIA COME TO THE CLOSED

ENVIRONMENT, THE WAY THEY

75
00:04:21,109 --> 00:04:28,340
SPREAD, AND UNDERSTANDING THAT
ENVIRONMENT OVER THE COURSE OF A

76
00:04:28,340 --> 00:04:29,340
ONE YEAR PERIOD.

77
00:04:29,340 --> 00:04:33,060
THIS HELPS US TO DESIGN FUTURE
STUDIES THAT WILL HAVE A CLOSE

78
00:04:33,060 --> 00:04:35,920
ENVIRONMENT BE SAFE FOR THE CREW
MEMBERS.

79
00:04:35,920 --> 00:04:39,400
WE ALSO HAVE EXPERIMENTS THAT
ARE REALLY MORE FOCUSED ON

80
00:04:39,400 --> 00:04:44,410
EITHER NATIONAL LAB, COMMERCIAL
OBJECTIVE, BENEFITS ON EARTH OR

81
00:04:44,410 --> 00:04:46,350
EDUCATIONAL OBJECTIVES ABOUT.

82
00:04:46,350 --> 00:04:49,600
AND NOT FOCUSED ON SPACE
EXPLORATION.

83
00:04:49,600 --> 00:04:55,340
EXAMPLES OF THOSE, LOOKING AT
YEAST.

84
00:04:55,340 --> 00:04:59,680
THESE ARE THE SIMPLEST COMPLEX
CELLS THAT YOU CAN STUDY AND SO

85
00:04:59,680 --> 00:05:03,150
SCIENTISTS ARE LOOKING AT HOW DO
YEAST COMMUNICATE WITH ONE

86
00:05:03,150 --> 00:05:05,260
ANOTHER WHEN THEY'RE FORMING A
COLONY.

87
00:05:05,260 --> 00:05:09,280
THIS IS KIND OF A MODEL FOR THE
WAY THAT STEM CELLS MIGHT

88
00:05:09,280 --> 00:05:12,290
COORDINATE WITH EACH OTHER AS
THEY START FORMING SOMETHING

89
00:05:12,290 --> 00:05:16,950
LIKE A TUMOR OR SOME KIND OF A
GROWTH THAT WE MIGHT WANT TO

90
00:05:16,950 --> 00:05:17,950
MAPPING.

91
00:05:17,950 --> 00:05:20,880
AND SO THE SCIENTISTS WILL BE
LOOKING AT THE COMMUNICATION

92
00:05:20,880 --> 00:05:23,740
USING AMMONIA BETWEEN THESE
CELLS AND HAVE DIFFERENT KINDS

93
00:05:23,740 --> 00:05:26,850
OF YEAST THAT HAVE DIFFERENT
GENES INCLUDED AND NOT INCLUDED

94
00:05:26,850 --> 00:05:30,440
TO HELP GET INSIGHT INTO THESE
PROCESS.

95

00:05:30,440 --> 00:05:34,070
AND THIS IS A NATIONAL
LABORATORY INVESTIGATION BY

96
00:05:34,070 --> 00:05:35,400
CASIS.

97
00:05:35,400 --> 00:05:39,790
ANOTHER SIDE OF INVESTIGATIONS
THAT WORKS CLOSELY WITH CASIS IS

98
00:05:39,790 --> 00:05:41,890
THE COMMERCIAL PARTNER NANORAX.

99
00:05:41,890 --> 00:05:45,949
IT FLY AS VARIETY OF SELF
CONTAINED SMALL EXPERIMENTS TO

100
00:05:45,949 --> 00:05:47,790
THE SPACE STATION EVERY FLIGHT.

101
00:05:47,790 --> 00:05:50,800
AND THIS IS A REALLY SPECIAL
FLIGHT BECAUSE THERE WERE A

102
00:05:50,800 --> 00:05:54,070
NUMBER OF STUDENTS WHO HAD
INVESTIGATIONS ON THE ORB 3

103
00:05:54,070 --> 00:05:57,610
FLIGHT THAT WERE LOST, SO
THEY'RE GETTING TO REFLY

104
00:05:57,610 --> 00:05:59,389
INVESTIGATIONS.

105
00:05:59,389 --> 00:06:03,449
THERE ARE DOZENS, BUT I PICKED A
COUPLE TO TELL YOU ABOUT AND

106

00:06:03,449 --> 00:06:07,110

THERE WILL BE STUDENTS TOMORROW
THAT WILL TELL YOU IN THEIR OWN

107

00:06:07,110 --> 00:06:10,150

WORDS ABOUT THEIR
INVESTIGATIONS, AS WELL.

108

00:06:10,150 --> 00:06:14,919

ONE OF THESE IS AN EXPERIMENT
LOOKING AT CORELLA ALGAE, THEY

109

00:06:14,919 --> 00:06:17,800

GROW IN A FRESH WATER POND AND
THEY'RE INTERESTING IN SEEING IF

110

00:06:17,800 --> 00:06:21,570

THE PHOTOSYNTHESIS CHANGES
BETWEEN THE GROUND BEING IN

111

00:06:21,570 --> 00:06:22,570

SPACE.

112

00:06:22,570 --> 00:06:25,080

SO THEY WILL LET THE ALGAE GROW
AND MEASURE THE AMOUNT OF OXYGEN

113

00:06:25,080 --> 00:06:26,479

THEY PRODUCE.

114

00:06:26,479 --> 00:06:33,390

ANOTHER GREAT INVESTIGATION IS
BE RAD SHIELDING.

115

00:06:33,390 --> 00:06:36,169

IT'S STUDENTS THAT ARE FLYING
BASICALLY LITTLE GUIDER COUNTER

116

00:06:36,169 --> 00:06:39,199

AND THEY HAVE A PIECE OF
MATERIAL THAT IS A CANDIDATE FOR

117

00:06:39,199 --> 00:06:41,620

SHIELDING FOR FUTURE SPACE
MISSIONS.

118

00:06:41,620 --> 00:06:45,509

SO THESE STUDENTS HAVE LOOKED AT
HIGH DENSITY POLYETHYLENE WHICH

119

00:06:45,509 --> 00:06:48,190

IS A PLASTIC THAT YOU'RE
PROBABLY FAMILIAR WITH, BUT THIS

120

00:06:48,190 --> 00:06:52,360

ONE IS INFUSED WITH BORON SO
LOOKING AT THE SHIELDING

121

00:06:52,360 --> 00:06:57,960

MATERIAL THAT WILL PROTECT
AGAINST RADIATION.

122

00:06:57,960 --> 00:07:01,509

IT WILL BE MOVED IN FRONT OF AND
AWAY FROM THE GUIDER COUNTER AND

123

00:07:01,509 --> 00:07:03,740

THEY CAN TAKE MEASUREMENTS FROM
THAT.

124

00:07:03,740 --> 00:07:08,570

AND ONE THING GREAT ABOUT IT,
ESPECIALLY THE CORELLA

125

00:07:08,570 --> 00:07:10,120

INVESTIGATION, STUDENTS STARTED
ON THAT WHEN THEY WERE IN HIGH

126

00:07:10,120 --> 00:07:13,680

SCHOOL AND NOW THEY HAVE GONE ON
TO WORK WITH COLLEGE PROFESSORS

127

00:07:13,680 --> 00:07:15,690

TO DO SOME OF THE PROGRAMMING
THEMSELVES.

128

00:07:15,690 --> 00:07:18,780

SO GREAT TO SEE STUDENTS GROWING
UP AND WORKING ON THESE

129

00:07:18,780 --> 00:07:21,910

INVESTIGATIONS OVER THEIR
ACADEMIC CAREERS.

130

00:07:21,910 --> 00:07:25,860

SO AS I MENTIONED, WE HAVE
EXPLORATION FOCUSED RESEARCH AND

131

00:07:25,860 --> 00:07:29,460

WE HAVE COMMERCIAL NATIONAL LAB
EARTH BENEFITS FOCUSED RESEARCH

132

00:07:29,460 --> 00:07:30,720

ON THE SPACE STATION.

133

00:07:30,720 --> 00:07:35,160

AND WE'LL HAVE A NUMBER OF
SCIENTISTS HERE TO TALK TO YOU

134

00:07:35,160 --> 00:07:37,740

ABOUT THEIR SPECIFIC RESEARCH IN
THOSE AREAS.

135

00:07:37,740 --> 00:07:41,020

IN THE MEANTIME, IF YOU WANT TO
KEEP TRACK OF ALL 350

136

00:07:41,020 --> 00:07:43,370

INVESTIGATIONS AND HEAR ABOUT

HIGHLIGHTS GOING ON, YOU CAN

137

00:07:43,370 --> 00:07:46,919

ALWAYS FOLLOW ME ON TWITTER @ISS
UNDERScore RESEARCH.

138

00:07:46,919 --> 00:07:52,250

AND I'D BE HAPPY TO TAKE
QUESTIONS ABOUT OUR RESEARCH.

139

00:07:52,250 --> 00:07:55,460

THANKS.

140

00:07:55,460 --> 00:08:03,150

>> IF YOU HAVE A QUESTION, STATE
YOUR NAME AND AFFILIATION.

141

00:08:03,150 --> 00:08:05,360

GO AHEAD.

142

00:08:05,360 --> 00:08:06,470

>> HI.

143

00:08:06,470 --> 00:08:10,759

KEN CRAMER FOR UNIVERSE TODAY
NORTHEAST ASTRONOMY FORUM.

144

00:08:10,759 --> 00:08:13,350

FOR JULIE, I WONDER IF YOU COULD
REVIEW A LITTLE BIT ABOUT THE

145

00:08:13,350 --> 00:08:15,210

ONE YEAR CREW.

146

00:08:15,210 --> 00:08:18,990

WHAT HAVE WE LEARNED SO FAR,
WHAT ARE THEY GO CUSSING ON?

147

00:08:18,990 --> 00:08:22,120

AND SECOND QUESTION IS ABOUT THE
FOOD THAT CAME BACK.

148

00:08:22,120 --> 00:08:26,270

YOU SAID†-- WHAT WAS THE RESULT
THAT YOU FOUND THAT WOULD ENABLE

149

00:08:26,270 --> 00:08:30,180

YOU TO ACTUALLY ALLOW THE
ASTRONAUTS TO ALLOW THEM TO EAT

150

00:08:30,180 --> 00:08:35,119

THE NEW FOOD, THE CABBAGE THAT
YOU ARE SENDING UP NOW?

151

00:08:35,119 --> 00:08:42,180

>> THE ONE YEAR EXPEDITION IS
REALLY EXCITING.

152

00:08:42,180 --> 00:08:47,910

WE HAVE AN ASTRONAUT SCOTT KELLY
AND A COSMONAUT THAT ARE BOTH

153

00:08:47,910 --> 00:08:49,860

PARTICIPATING.

154

00:08:49,860 --> 00:08:55,550

IT'S COLLABORATIVE BETWEEN U.S.
AND RUSSIAN SCIENTISTS.

155

00:08:55,550 --> 00:09:00,570

YOU'LL HEAR ABOUT ONE OF THOSE
TODAY.

156

00:09:00,570 --> 00:09:05,610

BUT WE THINK THEY'RE GOING
INCREDIBLY WELL IN A NUMBER OF

157

00:09:05,610 --> 00:09:07,700

MEETINGS WITH OUR RUSSIAN

COLLEAGUES WHERE WE WERE

158

00:09:07,700 --> 00:09:10,240

PREVIEWING SOME OF THE EARLY
DATA THAT HAS COME DOWN EVEN

159

00:09:10,240 --> 00:09:12,470

BEFORE PUBLICATION.

160

00:09:12,470 --> 00:09:16,590

WHAT I'M REALLY SEEING IS A HUGE
INFLUENCE ON THE WAY THAT WE

161

00:09:16,590 --> 00:09:23,709

WILL BE ABLE TO EXPLORE AS A
SPECIES IN THE FUTURE AS WE GET

162

00:09:23,709 --> 00:09:25,779

THOSE EXPERIENCES TOGETHER INTO
COMMON PRINCIPLES.

163

00:09:25,779 --> 00:09:30,370

SO SOME OF THE AREAS WE'RE WORK
ON ARE BEHAVIOR AND PERFORMANCE,

164

00:09:30,370 --> 00:09:34,620

SLEEP DEFICIT, THE ABILITY TO DO
COMPLEX TASKS RIGHT AFTER YOU

165

00:09:34,620 --> 00:09:40,350

LAND, WE'RE ALSO LOOK AT THE
HEALTH OF THE CREW ON ORBIT, AND

166

00:09:40,350 --> 00:09:43,680

IN THEIR EXERCISE REGIMES AND
FLUID SHIFT AND SO FORTH.

167

00:09:43,680 --> 00:09:50,490

SO ITS A REALLY EXCITING TIME.

168

00:09:50,490 --> 00:09:52,730

WHAT WE DID WITH THE ROMAINE
LETTUCE, WE BROUGHT IT HOME, WE

169

00:09:52,730 --> 00:09:57,520

DIDN'T LET THE CREW EAT IT, WE
TESTED IT FOR BACTERIA.

170

00:09:57,520 --> 00:10:00,490

THE GOAL IS TO†-- BECAUSE WE
KNOW THAT MICROBES CAN BE MORE

171

00:10:00,490 --> 00:10:08,950

VIRULENT IN ORBIT, WE'RE
CONCERNED BUGS MIGHT GROW MORE

172

00:10:08,950 --> 00:10:12,870

RAPIDLY THERE THAN A GARDEN ON
EARTH.

173

00:10:12,870 --> 00:10:19,740

YOU JUST MAYBE WASH IT IN WATER
AND THEN YOU EAT IT AND THAT'S

174

00:10:19,740 --> 00:10:20,740

FINE.

175

00:10:20,740 --> 00:10:23,370

SO WE WANT TO BE SURE THERE IS
NOTHING GROWING ON THE LETTUCES

176

00:10:23,370 --> 00:10:26,870

AND SO FORTH THAT COULD CAUSE
HARM AND MAKE THE CREW SICK.

177

00:10:26,870 --> 00:10:29,690

SO WHEN WE TESTED THAT, IT
LOOKED REALLY GOOD.

178

00:10:29,690 --> 00:10:33,399
THE VEGGIE SYSTEM USES THESE
DISPOSABLE PLANT PILLOWS TO GROW

179
00:10:33,399 --> 00:10:37,160
THEM IN SO THEY CAN COME IN
SANITIZED EVERY TIME SO YOU'RE

180
00:10:37,160 --> 00:10:41,330
NOT ADDING BACTERIA AS AND YOU
GROW PLANTS OVER AND OVER.

181
00:10:41,330 --> 00:10:44,900
SO I THINK WE'RE GETTING CLOSE
ON IT THAT FIRST BITE OF SPACE

182
00:10:44,900 --> 00:10:45,959
LETTUCE.

183
00:10:45,959 --> 00:10:53,069
>> DO YOU FORESEE THEM EATING
VEGGIE EXPERIMENTS SOON?

184
00:10:53,069 --> 00:10:54,190
>> I DO.

185
00:10:54,190 --> 00:10:56,100
AND THERE ARE A COUPLE REASONS
FOR THAT.

186
00:10:56,100 --> 00:10:59,560
ONE IS THAT WHEN THE CREW
MEMBERS EAT ONLY PRESERVED

187
00:10:59,560 --> 00:11:02,740
FOODS, THEY DO START HAVING
NUTRITIONAL DEFICIENCIES OVER

188
00:11:02,740 --> 00:11:03,740
TIME.

189

00:11:03,740 --> 00:11:07,580

NOT EVERYTHING IS WELL PRESERVED
IN A PILL FORM, PRESERVED FOOD

190

00:11:07,580 --> 00:11:11,450

IS BETTER THAN JUST TAKING
VITAMIN PILLS, WE'VE HAD SOME

191

00:11:11,450 --> 00:11:12,720

STUDIES THAT SHOWED THAT.

192

00:11:12,720 --> 00:11:16,470

BUT IN FACT AS WE ALL KNOW FROM
OUR HEALTH ON EARTH, EATING

193

00:11:16,470 --> 00:11:20,390

FRESH LEAFY GREENS IS A REALLY
IMPORTANT PART OF A BALANCED

194

00:11:20,390 --> 00:11:21,390

DIET.

195

00:11:21,390 --> 00:11:23,649

AND SO IF YOU THINK ABOUT
EXPLORATION MISSIONS THAT ARE

196

00:11:23,649 --> 00:11:26,770

MUCH LONGER THAN THE SIX MONTHS
WE'RE TYPICALLY DOING ON ISS,

197

00:11:26,770 --> 00:11:29,230

CERTAINLY A ONE YEAR MISSION IT
STARTS MARRYING MORE.

198

00:11:29,230 --> 00:11:32,820

AND WE BRING FRUITS AND
VEGETABLES UP TO THE CREW WHEN

199

00:11:32,820 --> 00:11:36,200
WE LAUNCH A FLIGHT, BUT SOME DAY
WHEN WE'RE GOING TO MAR, WE

200
00:11:36,200 --> 00:11:39,320
WON'T HAVE THE ABILITY TO BRING
FRESH FRUITS AND VEGGIES TO

201
00:11:39,320 --> 00:11:40,320
THEM.

202
00:11:40,320 --> 00:11:43,779
SO VEGGIE PROVIDES AN
ALTERNATIVE SO THEY CAN GROW A

203
00:11:43,779 --> 00:11:50,850
LITTLE BIT OF THEIR VITAMINS AND
IMPROVE THEIR NUTRITION AND

204
00:11:50,850 --> 00:11:53,810
MENTAL HEALTH, TOO.

205
00:11:53,810 --> 00:11:56,610
>> KIM SIEGEL.

206
00:11:56,610 --> 00:12:00,430
CELEBRATION NEWS.

207
00:12:00,430 --> 00:12:05,591
I HAVE A GENERAL QUESTION ABOUT,
WELL, LET ME PUT THIS WAY, MY

208
00:12:05,591 --> 00:12:10,110
READERS ARE INTERESTED IN THE
BENEFITS OF THESE VARIOUS

209
00:12:10,110 --> 00:12:11,410
EXPERIMENTS.

210

00:12:11,410 --> 00:12:15,670
NOT ONLY TO ASTRONAUTS, BUT
MAYBE IMPORTANTLY TO PEOPLE HERE

211
00:12:15,670 --> 00:12:17,630
ON EARTH.

212
00:12:17,630 --> 00:12:19,010
WHAT BENEFITS THEY WILL HAVE.

213
00:12:19,010 --> 00:12:24,510
NOW, I WAS READING A LITTLE BIT
ABOUT THE EXPERIMENT HAVING TO

214
00:12:24,510 --> 00:12:29,170
DO WITH CHROMOSOMES AND THE ENDS
OF THE CHROMOSOMES AND I WONDER

215
00:12:29,170 --> 00:12:33,790
IF YOU COULD COMMENT ON WHETHER
YOU THOUGHT THAT EXPERIMENT,

216
00:12:33,790 --> 00:12:37,720
FIRST OF ALL, THAT EXPERIMENT
HAS SOME BENEFIT TO PEOPLE ON

217
00:12:37,720 --> 00:12:42,350
EARTH ULTIMATELY AND SECONDLY
ARE THERE ANY OTHER EXPERIMENTS

218
00:12:42,350 --> 00:12:46,610
THAT ARE ON BOARD THAT MIGHT
HAVE A PARTICULAR BENEFIT TO

219
00:12:46,610 --> 00:12:47,810
EARTH-BOUND HUMANS.

220
00:12:47,810 --> 00:12:51,640
>> YES, IT'S INTERESTING YOU
MENTION THAT.

221

00:12:51,640 --> 00:12:56,620

BACK TO BASIC BIOLOGY, ON THE
ENDS OF CHROMOSOMES, THEY'RE

222

00:12:56,620 --> 00:12:59,990

IMPORTANT FOR HAVING THE
CHROMOSOMES ALINE PROPERLY WHEN

223

00:12:59,990 --> 00:13:02,740

THE CELL DIVIDES.

224

00:13:02,740 --> 00:13:05,180

IT'S BEEN SHOWN IN SOME
ORGANISMS AND SOME CELL LINES

225

00:13:05,180 --> 00:13:08,920

THAT AS THE CELL LINE AGES, THEY
GET SHORTER AND SHORTER.

226

00:13:08,920 --> 00:13:12,580

SO THIS REALLY HAS TO DO WITH
ACCURATE PRODUCTION OF CELLS AND

227

00:13:12,580 --> 00:13:13,580

AGING.

228

00:13:13,580 --> 00:13:16,910

AND IF YOU START THINKING ABOUT
THAT, WHAT DOES THAT KIND OF

229

00:13:16,910 --> 00:13:21,910

KNOWLEDGE MEAN FOR THE BASICS OF
HOW WE UNDERSTAND ILLNESS, YOU

230

00:13:21,910 --> 00:13:25,470

KNOW, ONE OF THE THINGS WE SEE
AS PEOPLE AGE, REPRODUCTION OF

231

00:13:25,470 --> 00:13:29,220
CELLS, CELLS HAVE MORE AND MORE
ERRORS IN THEM.

232
00:13:29,220 --> 00:13:30,850
MUTATIONS ARE MORE LIKELY.

233
00:13:30,850 --> 00:13:33,610
SO IT REALLY LINKS TO AGEING.

234
00:13:33,610 --> 00:13:36,870
AND THE OTHER THING OF COURSE
THAT HAPPENS IN SPACE THAT

235
00:13:36,870 --> 00:13:40,470
DOESN'T HAPPEN ON THE GROUND, IT
IS THE LESS FRIENDLY RADIATION

236
00:13:40,470 --> 00:13:41,470
ENVIRONMENT.

237
00:13:41,470 --> 00:13:47,269
NOT AS BAD AS DEEP SPACE, BUT
THOSE FACTORS ARE ALSO PART OF

238
00:13:47,269 --> 00:13:49,500
CHANGES THAT WE SEE TO
CHROMOSOMES ON THE SPACE

239
00:13:49,500 --> 00:13:50,500
STATION.

240
00:13:50,500 --> 00:13:52,740
SO THESE KINDS OF STUDIES THAT
ARE REALLY TRYING TO UNDERSTAND

241
00:13:52,740 --> 00:13:57,329
THE MECHANISMS OF CELL DIVISION
AND HOW THOSE RELATE TO ERRORS

242

00:13:57,329 --> 00:14:00,110

THAT HAPPEN IN CELL DIVISION,
THOSE ARE AT THE CORE OF

243

00:14:00,110 --> 00:14:04,010

UNDERSTANDING AGING AND PERHAPS
EVEN IMPROVING OUR LIFE AND HEAD

244

00:14:04,010 --> 00:14:05,800

BACK HERE ON EARTH.

245

00:14:05,800 --> 00:14:20,430

ONE THING EXCITING IS IT OPENS
UP THE KINDS OF EXPERIMENTS THAT

246

00:14:20,430 --> 00:14:25,410

MIGHT BE BENEFITTING LIFE ON
EARTH BUT NOT THE FUTURE

247

00:14:25,410 --> 00:14:26,410

EXPLORATION.

248

00:14:26,410 --> 00:14:33,110

SO NOW WE HAVE A NICE 50/50 MIX
WHERE†-- AND YOU'LL HEAR ABOUT

249

00:14:33,110 --> 00:14:35,770

SOME TODAY THAT ARE MOSTLY
FOCUSED ON ASTRONAUT HEALTH,

250

00:14:35,770 --> 00:14:39,139

YOU'LL HEAR ABOUT OTHERS FOCUSED
ON MEDICAL APPLICATIONS BACK

251

00:14:39,139 --> 00:14:40,139

HERE ON EARTH.

252

00:14:40,139 --> 00:14:42,440

OF COURSE THE GREAT THING IS

SCIENCE IS ONE BODY OF

253

00:14:42,440 --> 00:14:43,440

KNOWLEDGE.

254

00:14:43,440 --> 00:14:46,209

SO AS WE LEARN MORE ABOUT
DECONDITIONING OF THE HEARTS IN

255

00:14:46,209 --> 00:14:49,470

ASTRONAUTS THIS, PROVIDES THE
INFORMATION ABOUT DECONDITIONING

256

00:14:49,470 --> 00:14:52,150

OF HEARTS IN PEOPLE THAT HAVE
BEEN INJURED BACK HERE ON EARTH.

257

00:14:52,150 --> 00:14:56,519

SO WE TRADE THAT INFORMATION
BACK AND FORTH AND ALMOST EVERY

258

00:14:56,519 --> 00:15:03,410

EXPERIMENT ON ISS OFTEN HAS A
KNOWLEDGE BENEFIT THAT COMES

259

00:15:03,410 --> 00:15:04,410

BACK HOME.

260

00:15:04,410 --> 00:15:06,519

>> FOR THOSE WATCHING AT HOME,
REMEMBER YOU WITH USE #ASKNASA

261

00:15:06,519 --> 00:15:08,709

IF YOU HAVE A QUESTION.

262

00:15:08,709 --> 00:15:17,690

>> HI, I'M CHRISTINE CORBETT
MORAN, AT CALTECH.

263

00:15:17,690 --> 00:15:22,820
I WAS CURIOUS TO BRING THINGS
BACK TO POTENTIAL MARS MISSIONS

264
00:15:22,820 --> 00:15:26,700
AND SPACE EXPLORATION, WHETHER
THERE HAVE SOCIAL SCIENCE

265
00:15:26,700 --> 00:15:32,470
EXPERIMENTS FOR EXAMPLE THE
PSYCHOLOGY OF LIVING FOR A YEAR

266
00:15:32,470 --> 00:15:35,350
OR MORE IN SPACE GOING ON.

267
00:15:35,350 --> 00:15:42,240
>> YES, THERE ARE SOCIAL SCIENCE
EXPERIMENTS COUCHED AS AREA

268
00:15:42,240 --> 00:15:46,170
BEHAVIORAL HEALTH AND
PERFORMANCE.

269
00:15:46,170 --> 00:15:49,829
ONE EXAMPLE OF THAT IS A STUDY
CALLED JOURNALS.

270
00:15:49,829 --> 00:15:52,480
THE CREW MEMBERS AND THIS IS
SOMETHING WE'VE DONE ON ISS WITH

271
00:15:52,480 --> 00:15:56,850
SIX MONTH CREWS FOR A NUMBER OF
EXPEDITIONS AND THAT STUDY WAS

272
00:15:56,850 --> 00:16:00,550
COMPLETED, WE WOKE THAT STUDY
BACK UP FOR THE ONE YEAR CREW,

273
00:16:00,550 --> 00:16:03,410

SO THAT THOSE CREW MEMBERS CAN
WRITE IN THEIR JOURNALS.

274

00:16:03,410 --> 00:16:06,589
AND THEN THERE IS A METHOD OF
ANALYZING THOSE LOOKING FOR

275

00:16:06,589 --> 00:16:10,529
SPECIFIC KEY WORDS THAT HAS BEEN
APPLIED TO THE JOURNALS OF

276

00:16:10,529 --> 00:16:15,910
EXPLORERS THROUGHOUT HISTORY.

277

00:16:15,910 --> 00:16:19,339
SO THOSE STUDIES REALLY HELP TO
UNDERSTAND MAYBE THINGS THAT THE

278

00:16:19,339 --> 00:16:21,649
CREW MEMBER MIGHT NOT RECOGNIZE
THEMSELVES, BUT THAT CAN BE

279

00:16:21,649 --> 00:16:23,980
REVEALED OBJECTIVELY IN THEIR
WRITING.

280

00:16:23,980 --> 00:16:28,149
ANOTHER EXAMPLE OF A SOCIAL
SCIENCE TYPE STUDY BEING DONE IS

281

00:16:28,149 --> 00:16:29,709
CALLED INTERACTIONS.

282

00:16:29,709 --> 00:16:32,279
AND THAT IS A STUDY WHERE WE
LOOK AT THE INTERACTIONS BETWEEN

283

00:16:32,279 --> 00:16:34,949
CREW MEMBERS AND THEIR
INTERACTIONS WITH THE GROUND TO

284

00:16:34,949 --> 00:16:38,920

UNDERSTAND THE SOCIAL DYNAMICS
AND HOW THOSE DYNAMICS AFFECT

285

00:16:38,920 --> 00:16:41,089

DECISIONS, CRITICAL DECISIONS
BEING MADE AND HOW THEY AFFECT

286

00:16:41,089 --> 00:16:42,339

COMMUNICATION.

287

00:16:42,339 --> 00:16:44,980

AND THOSE THINGS ARE REALLY
IMPORTANT BECAUSE HAVING GOOD

288

00:16:44,980 --> 00:16:47,480

COMMUNICATION WITH THE GROUND
AND GOOD DECISION MAKING IN A

289

00:16:47,480 --> 00:16:50,459

CRITICAL SITUATION CAN MEAN THE
DIFFERENCE BETWEEN A SUCCESSFUL

290

00:16:50,459 --> 00:16:53,800

MISSION AND A REALLY BAD DAY.

291

00:16:53,800 --> 00:16:56,550

>> LET'S MOVE ON TO OUR NEXT
PANELIST.

292

00:16:56,550 --> 00:17:02,010

>> I'M MIKE STENGER.

293

00:17:02,010 --> 00:17:07,199

I'M JUST ONE OF THREE PRINCIPAL
INVESTIGATORS ON THIS STUDY.

294

00:17:07,199 --> 00:17:15,909

THE OTHER TWO ARE SCOTT AND
ALAN, WE HAVE A TEAM OF 25

295

00:17:15,909 --> 00:17:17,949
COLLABORATORS FROM ALL OVER THE
WORLD INCLUDING RUSSIAN

296

00:17:17,949 --> 00:17:19,919
COLLABORATORS.

297

00:17:19,919 --> 00:17:23,270
AND THE REASON FOR THE
EXPERIMENT IS THE VISION ISSUES

298

00:17:23,270 --> 00:17:27,419
THAT WE'VE BEEN SEEING.

299

00:17:27,419 --> 00:17:31,070
THE NATION IS UP TO THREE
QUARTERS ARE COMING BACK WITH

300

00:17:31,070 --> 00:17:33,499
CHANGES IN OCCULAR STRUCTURE AND
VISION.

301

00:17:33,499 --> 00:17:36,169
ALL OF VARYING SEVERITY.

302

00:17:36,169 --> 00:17:39,529
IT'S UNCLEAR WHAT IS CAUSING
THIS AND WHY SOME HAVE MORE

303

00:17:39,529 --> 00:17:42,130
SEVERE ISSUES THAN OTHERS.

304

00:17:42,130 --> 00:17:48,999
THE HYPOTHESIS IS THAT THE FLUID
IS LEADING TO INTRACRANIAL

305

00:17:48,999 --> 00:17:50,970

PRESSURE.

306

00:17:50,970 --> 00:17:55,559

INTRACRANIAL PRESSURE HAS NEVER
BEEN MEASURED IN SPACE FLIGHT,

307

00:17:55,559 --> 00:17:57,539

SO IT'S JUST A HYPOTHESIS.

308

00:17:57,539 --> 00:18:04,400

THE EXPERIMENT IS TO TRY TO GAIN
MORE INFORMATION AS TO WHY THESE

309

00:18:04,400 --> 00:18:06,850

CHANGES ARE OCCURRING IN
ASTRONAUTS' EYES.

310

00:18:06,850 --> 00:18:11,769

SO IT'S A VERY LARGE EXPERIMENT,
VERY TIME CONSUMING USING ABOUT

311

00:18:11,769 --> 00:18:16,389

100 HOURS OF IN-FLIGHT CREW
TIMES TO COLLECT ALL THESE DATA

312

00:18:16,389 --> 00:18:20,549

AND OUR GOAL IS TO MEASURE
INDIVIDUAL ASTRONAUT'S RESPONSES

313

00:18:20,549 --> 00:18:24,679

TO THE HEAVY FLUID EXPERIENCES
BECAUSE THEY'RE ALL DIFFERENT.

314

00:18:24,679 --> 00:18:27,100

AND TO DETERMINE IF THERE IS A
RELATIONSHIP BETWEEN UNIQUE

315

00:18:27,100 --> 00:18:30,090

INDIVIDUAL RESPONSE TO THIS

HYPER FLUID SHIFT AND SUBSEQUENT

316

00:18:30,090 --> 00:18:33,879

CHANGES IN OCCULAR STRUCTURE OF
SWELLING OF THE EYE, CHANGING IN

317

00:18:33,879 --> 00:18:38,070

THE BACK OF THE EYE WHICH LEADS
TO CHANGES IN VISUAL ACUITY.

318

00:18:38,070 --> 00:18:42,109

SO THE STUDY IS WE HAVE
PRE-FLIGHT AND IN-FLIGHT

319

00:18:42,109 --> 00:18:43,320

TESTING.

320

00:18:43,320 --> 00:18:47,899

WE STUDY ASTRONAUTS WHILE
THEY'RE SITTING UPRIGHT, WE LAY

321

00:18:47,899 --> 00:18:53,009

THEM FLAT ON THEIR BACK TO CAUSE
FLUID SHIFT AND THEN LAY THEM

322

00:18:53,009 --> 00:18:58,850

DOWN TO CAUSE A MASSIVE FLUID
SHIFT TO THE HEAD.

323

00:18:58,850 --> 00:19:01,759

AND WHILE WE'RE IN THESE
DIFFERENT POSTURE, WE'RE

324

00:19:01,759 --> 00:19:04,340

COLLECTING A WHOLE HOST OF DATA.

325

00:19:04,340 --> 00:19:13,039

WE DO MRI, DRAINAGE OF THE CSF,
CHANGES IN THE VENTRICLES IN THE

326

00:19:13,039 --> 00:19:14,039

BRAIN.

327

00:19:14,039 --> 00:19:21,340

USING ULTRASOUND TO TRACK BLOOD
FLOW.

328

00:19:21,340 --> 00:19:24,129

WHEN YOU'RE SITTING UPRIGHT,
MOSTLY THE BLOOD IS DRAINING OUT

329

00:19:24,129 --> 00:19:27,080

OF THE BACK OF THE HEAD.

330

00:19:27,080 --> 00:19:29,249

JUGULAR VEIN IS COLLAPSED.

331

00:19:29,249 --> 00:19:32,409

WHEN YOU LAY DOWN, THE DRAINAGE
SWITCHES TO THE JUGULAR.

332

00:19:32,409 --> 00:19:36,279

AND THE ABILITY OF AN ASTRONAUT
TO DRAIN THEIR BRAIN MAY SOMEHOW

333

00:19:36,279 --> 00:19:39,809

IMPACT THE AMOUNT OF PRESSURE
THAT THEY'RE EXPERIENCING IN THE

334

00:19:39,809 --> 00:19:42,809

HEADED WHICH MAY BE IMPACTING
THE VISUAL SYNDROME.

335

00:19:42,809 --> 00:19:46,369

WE CAN ALSO USE ULTRA SOUND TO
MEASURE THE BLOOD FLOW IN AND

336

00:19:46,369 --> 00:19:50,070

AROUND THE EYE, LOOK AT THE

SHAPE OF THE EYE TO SEE IF IT'S

337

00:19:50,070 --> 00:19:51,070

FLATTENING.

338

00:19:51,070 --> 00:20:00,309

WE CAN ALSO USE ULTRASOUND TO
LOOK AT THE OPTIC NERVE.

339

00:20:00,309 --> 00:20:03,119

THE SHEATH TENDS TO DISTEND.

340

00:20:03,119 --> 00:20:06,049

HERE IS A VIDEO OF THAT.

341

00:20:06,049 --> 00:20:08,879

THE IDEA IS THAT THE INCREASED
PRESSURE IN THE BRAIN IS CAUSING

342

00:20:08,879 --> 00:20:11,720

A CHAIN IN THE SHIFT OF THE EYE
WHICH YOU CAN DETECT ON ULTRA

343

00:20:11,720 --> 00:20:13,510

SOUND.

344

00:20:13,510 --> 00:20:16,100

THE BACK OF THE EYE DOES
FLATTEN.

345

00:20:16,100 --> 00:20:19,710

AND SO ONE OF THE MAIN GOALS IS
TO DETERMINE WHY THIS IS

346

00:20:19,710 --> 00:20:20,980

OCCURRING.

347

00:20:20,980 --> 00:20:24,690

WE CAN ALSO ESTIMATE CHANGES IN

INTER-CRANIAL PRESSURE FOR THE

348

00:20:24,690 --> 00:20:28,229

FIRST TIME IN SPACE FLIGHT.

349

00:20:28,229 --> 00:20:35,090

ONE USES DISPLACEMENT AND OTHER
USES EMISSIONS.

350

00:20:35,090 --> 00:20:41,039

WE CAN ESTIMATE CHANGES IN ICP
BY USING SOUND WAVES IN THE EAR.

351

00:20:41,039 --> 00:20:44,970

SO CONTINUOUS FLUID COLUMN
BETWEEN THE BRAIN AND INNER EAR.

352

00:20:44,970 --> 00:20:50,090

IF THOSE CHANGES IN INTRACRANIAL
PRESSURE, WE CAN SEE THESE BY

353

00:20:50,090 --> 00:20:53,470

LOOKING AT THE SOUND WAVES.

354

00:20:53,470 --> 00:20:55,899

SO FOR THE FIRST TIME WE CAN
RELATE CHANGES IN INTAKE CRANIAL

355

00:20:55,899 --> 00:21:07,639

PRESSURE TO IT CHANGES IN VISUAL
ACUITY AND STRUCTURES OF THE

356

00:21:07,639 --> 00:21:08,849

EYE.

357

00:21:08,849 --> 00:21:15,580

AND WE HAVE A COUNTER MEASURE IN
MIND.

358

00:21:15,580 --> 00:21:18,669
IN ESSENCE IT SUCTION THE BLOOD
TO YOUR LOWER BODY.

359
00:21:18,669 --> 00:21:25,650
SO WE CAN REVERSE THAT BY
SUCKING THE BLOOD BACK DOWN IT

360
00:21:25,650 --> 00:21:29,289
TO THE LEGS AND SEEING HOW THIS
MAY OR MAY NOT ALLEVIATE SOME OF

361
00:21:29,289 --> 00:21:31,380
THE SYMPTOMS.

362
00:21:31,380 --> 00:21:36,549
SO SCOTT KELLY AND THE
COSMONAUT, THEY COMPLETED THEIR

363
00:21:36,549 --> 00:21:40,919
PRE-FLIGHT TESTING AND THEIR
FIRST IN-FLIGHT SESSION.

364
00:21:40,919 --> 00:21:42,529
LIKE I SAID, IT'S QUITE A BIT OF
TESTING.

365
00:21:42,529 --> 00:21:46,919
THEY HAVE FOUR DAYS OF TESTING
IN THE U.S. SEGMENT AND THEN

366
00:21:46,919 --> 00:21:51,499
THEY PACK UP ALL THE HARDWARE,
THE EYE CAMERAS, ULTRA SOUND

367
00:21:51,499 --> 00:21:56,389
MACHINE, TRANSPORT THEM OVER TO
THE RUSSIAN SEGMENT.

368
00:21:56,389 --> 00:21:58,849

THEY WILL SPEND THREE DAYS
COLLECTING DATA IN THE RUSSIAN

369

00:21:58,849 --> 00:22:02,999
SEGMENT.

370

00:22:02,999 --> 00:22:06,009
SO WE PLAN ON DOING TWO MORE
SESSIONS, MID POINT SESSION AND

371

00:22:06,009 --> 00:22:08,099
THEN ONE AT THE END OF THEIR ONE
YEAR MISSION.

372

00:22:08,099 --> 00:22:13,029
I'D BE HAPPY TO ANSWER ANY
QUESTIONS.

373

00:22:13,029 --> 00:22:15,149
>> ANY EARLY RESULTS?

374

00:22:15,149 --> 00:22:18,349
>> RESULTS, WE'VE SEEN WHAT YOU
WOULD EXPECT TO SEE.

375

00:22:18,349 --> 00:22:25,070
WE SEE VERY, VERY SLOWING OF THE
JUGULAR IN SOME CREW MEMBERS AND

376

00:22:25,070 --> 00:22:27,690
SOME DO NOT.

377

00:22:27,690 --> 00:22:32,849
SO WE HAVE SOME IDEAS, SOME
PREDICTIONS ON WHICH ONE MAY

378

00:22:32,849 --> 00:22:34,830
DEVELOP MORE SEVERE THAN THE
OTHER.

379

00:22:34,830 --> 00:22:43,080

AND THE VACUUM IS DOING WHAT WE
EXPECT TO DO.

380

00:22:43,080 --> 00:22:45,320

>> WE'LL TAKE YOUR QUESTIONS.

381

00:22:45,320 --> 00:22:46,320

REMEMBER TO WAIT FOR THE
MICROPHONE.

382

00:22:46,320 --> 00:22:48,740

STATE YOUR NAME AND AFFILIATION.

383

00:22:48,740 --> 00:22:52,590

>> JIM CRAMER, NORTHEAST
ASTRONOMY TORE RUM.

384

00:22:52,590 --> 00:22:56,769

YOU TALKED ABOUT THE OCCULAR
DEEP GENERATION UP TO THREE

385

00:22:56,769 --> 00:22:58,879

QUARTERS IN SPACE.

386

00:22:58,879 --> 00:23:01,270

WHAT IS THE EFFECT WHEN THEY
COME BACK FROM SPACE, DO THEY

387

00:23:01,270 --> 00:23:05,299

ALL RECOVER OR DO SOME HAVE
PERMANENT DAMAGE AND IF THERE IS

388

00:23:05,299 --> 00:23:10,289

PERMANENT DAMAGE, CAN YOU
IMAGINE SOME WAY TO TREAT THAT.

389

00:23:10,289 --> 00:23:12,239

THANKS.

390

00:23:12,239 --> 00:23:14,359

>> MOST OF THE ASTRONAUTS DO
RECOVER.

391

00:23:14,359 --> 00:23:17,090

AND THE REASON THIS IS IMPORTANT
IS BECAUSE THERE ARE A HANDFUL

392

00:23:17,090 --> 00:23:20,559

OF ASTRONAUTS WHO HAVE NOT EVEN
AFTER SEVERAL YEARS OF BEING

393

00:23:20,559 --> 00:23:21,700

BACK ON EARTH.

394

00:23:21,700 --> 00:23:27,659

AND THE VISUAL ACUITY YOU CAN
CORRECT WITH EYE GLASS, BUT

395

00:23:27,659 --> 00:23:32,149

THERE ARE STRUCTURAL CHANGES TO
THE EYE THAT HAVE NOT RECOVERED

396

00:23:32,149 --> 00:23:41,450

AND I DON'T THINK THERE IS A WAY
TO FIX THAT.

397

00:23:41,450 --> 00:23:44,590

>> JIM SIEGEL WITH CELEBRATION
NEWS.

398

00:23:44,590 --> 00:23:49,830

I UNDERSTAND WHY YOU WOULD BE
TRYING TO DEVELOP DEVICES TO

399

00:23:49,830 --> 00:23:52,769

MINIMIZE THESE PROBLEMS ON THE
ASTRONAUTS.

400

00:23:52,769 --> 00:23:54,960

BUT I'LL ASK YOU THE SAME
QUESTION THAT I ASKED DR.

401

00:23:54,960 --> 00:24:00,609

ROBINSON A MINUTES AGO ABOUT CAN
YOU ENVISION SOME SORT OF

402

00:24:00,609 --> 00:24:05,399

BENEFITS TO EARTH BOUND PEOPLE
AS A CONSEQUENCE OF THE

403

00:24:05,399 --> 00:24:07,469

EXPERIMENTS THAT YOU'RE DOING UP
IN THE ISS.

404

00:24:07,469 --> 00:24:08,469

>> CERTAINLY.

405

00:24:08,469 --> 00:24:15,729

TWO OF THE NEW DEVICES THAT
WE'RE FLYING ARE NONINVASIVE

406

00:24:15,729 --> 00:24:16,729

DEVICES.

407

00:24:16,729 --> 00:24:20,469

ON EARTH, IF YOU HAD A PATIENT
THAT HAD ELEVATED INTRACRANIAL

408

00:24:20,469 --> 00:24:25,779

PRESSURE, IN ORDER TO ESTIMATE
THAT PRESSURE YOU WOULD HAVE TO

409

00:24:25,779 --> 00:24:28,720

DO AN INVASIVE PROCEDURE LIKE A
SPINAL TAB TO GET AT THE LUMBAR

410

00:24:28,720 --> 00:24:35,960

PUNCTURE OR IMPLANT IN THE BRAIN
WHICH COMES WITH RISK.

411

00:24:35,960 --> 00:24:43,149

SO THERE ARE THOSE ON EARTH
INVESTIGATING THESE TOOLS.

412

00:24:43,149 --> 00:24:49,619

IT'S HELPFUL THAT THESE WILL
PREVENT CERTAIN PATIENTS FROM

413

00:24:49,619 --> 00:24:52,320

HAVING TO WITHSTAND INVASIVE
PROCEDURES.

414

00:24:52,320 --> 00:24:55,289

THESE TWO DEVICES POINT OF NOTE
THEY DON'T DIRECTLY MEASURE

415

00:24:55,289 --> 00:24:58,299

INTRACRANIAL PRESSURES BUT THEY
CAN ESTIMATE CHANGES.

416

00:24:58,299 --> 00:25:05,239

SO IF YOU CHANGE POSTURE OR IF
YOU GO TO SPACE FOR EXAMPLE.

417

00:25:05,239 --> 00:25:10,849

>> JARED HEYWORTH WITH SPACE
FLIGHT INSIDER.

418

00:25:10,849 --> 00:25:14,049

MY QUESTION IS HAS YOUR RESEARCH
SHOWN ANY SORT OF CORRELATION

419

00:25:14,049 --> 00:25:16,859

BETWEEN VISUAL DEFECTS THAT ARE
WERE PRE-EXISTING LIKE

420

00:25:16,859 --> 00:25:21,229

NEARSIGHTEDNESS WITH BEING
AFFECTED BY THESE FLUID PRESSURE

421

00:25:21,229 --> 00:25:25,840

CHANGES IN ORBIT OR TO ASK IT A
DIFFERENT WAY, IS IT STILL TRUE

422

00:25:25,840 --> 00:25:28,919

THAT SOMEONE WITH 20/20 VISION
WOULD MAKE THE BEST ASTRONAUT

423

00:25:28,919 --> 00:25:29,919

CANDIDATE?

424

00:25:29,919 --> 00:25:30,919

>> INTERESTING QUESTION.

425

00:25:30,919 --> 00:25:37,710

YOU KNOW, I THINK THE ANSWER IS
THAT THE SEVERITY OF YOUR VISUAL

426

00:25:37,710 --> 00:25:41,399

DEFICIT DOES NOT PLAY A PART
INTO HOW MUCH WORSE IT GETS.

427

00:25:41,399 --> 00:25:44,590

I THINK THAT SOME ASTRONAUTS ARE
GETTING BETTER WHEN THEY GO INTO

428

00:25:44,590 --> 00:25:45,590

SPACE.

429

00:25:45,590 --> 00:25:48,130

SO I'M DEFINITELY NOT AN
OPHTHALMOLOGIST, BUT I THINK

430

00:25:48,130 --> 00:25:53,349

THOSE THAT CAN'T SEE FAR CAN SEE
FAR BETTER.

431

00:25:53,349 --> 00:26:02,809

I MAY BE WRONG ABOUT THAT, BUT
IT CHANGES THAT FOCAL LENGTH.

432

00:26:02,809 --> 00:26:05,179

>> OKAY.

433

00:26:05,179 --> 00:26:07,549

ALESSANDRO.

434

00:26:07,549 --> 00:26:15,590

>> I'M CHAIR AND PROFESSOR
DEPARTMENT OF NANO MEDICINE IN

435

00:26:15,590 --> 00:26:17,159

HOUSTON.

436

00:26:17,159 --> 00:26:21,529

OUR DEPARTMENT IS FULLY FOCUSED
ON DEVELOPING TECHNOLOGIES NOW,

437

00:26:21,529 --> 00:26:23,039

TECHNOLOGIES FOR MEDICAL
APPLICATIONS.

438

00:26:23,039 --> 00:26:30,049

I'VE BEEN DOING THIS WORK IN
COLLABORATION WITH THE PIONEER

439

00:26:30,049 --> 00:26:33,809

IN THE APPLICATION ON TECHNOLOGY
FOR MEDICINE.

440

00:26:33,809 --> 00:26:36,629

THE EXPERIMENT THAT WE ARE
LAUNCHING TO THE INTERNATIONAL

441

00:26:36,629 --> 00:26:40,370

SPACE STATION STANDS FOR A REAL

PROBLEM THAT WE HAVE IN THE

442

00:26:40,370 --> 00:26:45,909

DEVELOPMENT OVER IMPLANTABLE FOR
APPLICATION DOWN HERE ON EARTH.

443

00:26:45,909 --> 00:26:48,779

SO WE DEVELOP IMPLANTS.

444

00:26:48,779 --> 00:26:55,369

WE CAN SEE IN THE FIRST FIGURE
DEVELOPING IMPLANTS, CAN DELIVER

445

00:26:55,369 --> 00:27:00,440

A DRUG IN A VERY CONTROLLED
FASHION RANGING FROM MONTHS UP

446

00:27:00,440 --> 00:27:01,440

TO YEARS.

447

00:27:01,440 --> 00:27:05,649

AND IT DELIVER A DRUG TO THE
PATIENT THAT MAY NEED IT

448

00:27:05,649 --> 00:27:07,099

CHRONICALLY.

449

00:27:07,099 --> 00:27:10,599

SO THAT THE PATIENT DOESN'T NEED
TO HAVE THE MULTIPLE INJECTIONS

450

00:27:10,599 --> 00:27:13,129

OR MULTIPLE DRUG ADMINISTRATION.

451

00:27:13,129 --> 00:27:17,629

SO BY DOING THIS, WE ARE ABLE TO
IMPROVE THE EFFICACY OF REMOVING

452

00:27:17,629 --> 00:27:22,350

THE PROBLEM OF COMPLIANCE AS
WELL AS REDUCING POTENTIAL SIDE

453

00:27:22,350 --> 00:27:26,340

EFFECTS TO THE ROUTE OF
ADMINISTRATION.

454

00:27:26,340 --> 00:27:34,289

NOW, THE SECOND FIGURE SHOWS THE
MEMBRANES THAT WE HAVE DEVELOPED

455

00:27:34,289 --> 00:27:38,389

ROUGHLY THREE TIMES THE SIZE OF
THE MOLECULE THAT WE WANT TO

456

00:27:38,389 --> 00:27:39,399

DELIVER.

457

00:27:39,399 --> 00:27:43,239

REASON BEING THAT WE HAVE
OBSERVED THAT IF YOU USE THAT

458

00:27:43,239 --> 00:27:47,859

SMALL, YOU CAN CHIEF A CONSTANT
DELIVERY OF THESE DRUGS OUT OF

459

00:27:47,859 --> 00:27:51,399

AN IMPLANTED RESERVOIR FOR AN
EXTENDED PERIOD OF TIME UNTIL

460

00:27:51,399 --> 00:27:57,519

IT'S BEEN COMPLETELY
ADMINISTERED.

461

00:27:57,519 --> 00:28:01,320

SO THESE ALLOW TO US DO CONTROL
DRUG DELIVERY WITHOUT ANY SORT

462

00:28:01,320 --> 00:28:06,639

OF PUMPING MECHANISM OR COMPLEX

ASSISTANCE THAT MAY BE HAVING

463

00:28:06,639 --> 00:28:08,879

PROBLEMS DOWN THE LINE DURING
THE TREATMENT.

464

00:28:08,879 --> 00:28:11,820

MAY RENDER YOUR SYSTEM MUCH
COMPLEX.

465

00:28:11,820 --> 00:28:16,110

SO THE MAJOR PROBLEM LIMITATION
THAT WE HAD WAS IN DEVELOPING

466

00:28:16,110 --> 00:28:21,049

THIS SYSTEM, WE HAVE USED
PRIMARILY EXPERIMENTAL ANALYSIS.

467

00:28:21,049 --> 00:28:33,120

WE WANTED TO DEFINE A
MATHEMATICAL MODEL.

468

00:28:33,120 --> 00:28:39,320

SO THE MAJOR PROBLEM IS THAT THE
NANO SCALE, THE MOLECULE

469

00:28:39,320 --> 00:28:46,269

TRANSPORT INTO AND OUT OF
CHANNEL IS AFFECTED BY THE

470

00:28:46,269 --> 00:28:49,830

ABSORPTION OF THE MOLECULE ON TO
THE SURFACE AS WELL AS

471

00:28:49,830 --> 00:28:55,019

MULTIRADIANCE AND AS WELL AS
PHYSICAL HINDRANCE.

472

00:28:55,019 --> 00:29:01,639

SO WE TRIED TO DECOUPLE THE

SYSTEM BY SCALING OUR MODEL FROM

473

00:29:01,639 --> 00:29:05,059

THE NANO SCALE FROM THE MOLECULE
INTO THE NANA CHANNEL INTO THE

474

00:29:05,059 --> 00:29:06,429

MICROCHANNEL.

475

00:29:06,429 --> 00:29:14,499

THIS ALLOWS US MUCH BETTER
CONTROL OF THE COMPONENTS OF OUR

476

00:29:14,499 --> 00:29:16,749

SYSTEM.

477

00:29:16,749 --> 00:29:21,679

AND WE CAN ACTUALLY OBSERVE AN
IMAGE THROUGH A REGULAR

478

00:29:21,679 --> 00:29:23,570

FLUORESCENT MICROSCOPE.

479

00:29:23,570 --> 00:29:38,950

SO

480

00:29:38,950 --> 00:29:41,479

WE WILL TEST THE DIFFUSION.

481

00:29:41,479 --> 00:29:45,119

AND IT WILL BE AS ACCEPT BED ON
THE LIVE MICROSCOPE MODEL ON THE

482

00:29:45,119 --> 00:29:46,850

INTERNATIONAL SPACE STATION.

483

00:29:46,850 --> 00:29:51,259

SO THIS DEVICE INCLUDES 12
DIFFERENT CHIPS.

484

00:29:51,259 --> 00:29:54,200

WE WILL IMAGE THEM
AUTOMATICALLY.

485

00:29:54,200 --> 00:29:59,330

THE IMAGE CONTROL AND THE IMAGE
CAPTURE WILL BE CONTROLLED BY

486

00:29:59,330 --> 00:30:03,769

THE GLENN RESEARCH CENTER AND WE
WILL RECEIVE THE IMAGE OF THESE

487

00:30:03,769 --> 00:30:05,139

PARTICLES ALONG THE
MICROCHANNEL.

488

00:30:05,139 --> 00:30:09,580

WE'LL DO THE ANALYSIS OF THESE
AND FROM THE ANALYSIS COLLECT

489

00:30:09,580 --> 00:30:13,469

INFORMATION FOR PREDICTIVE MATH
MODEL.

490

00:30:13,469 --> 00:30:22,909

SO OUR HOPE IS THAT WE WILL
SHINE LIGHT INTO THE COMPLEX

491

00:30:22,909 --> 00:30:27,779

MECHANISM OF TRANSPORT THAT
OTHERWISE CANNOT BE DONE DOWN

492

00:30:27,779 --> 00:30:32,039

HERE ON EARTH AND BEING ABLE TO
UTILIZE IT FOR REAL MEDICAL

493

00:30:32,039 --> 00:30:35,149

APPLICATION.

494

00:30:35,149 --> 00:30:39,259

WHICH BY THE WAY ARE GETTING
VERY CLOSE TO REAL CLINICAL USE

495

00:30:39,259 --> 00:30:45,219

IN COLLABORATION WITH A COMPANY
LOCATED IN AUSTIN, TEXAS.

496

00:30:45,219 --> 00:30:51,119

SO I'VE BEEN COLLABORATING WITH
THE UNIVERSITY OF COLORADO AS

497

00:30:51,119 --> 00:31:01,490

WELL AS OHIO, CLEVELAND, AS WELL
AS POLYTECH.

498

00:31:01,490 --> 00:31:04,970

IF YOU HAVE ANY QUESTION, I'D BE
HAPPY TO ANSWER.

499

00:31:04,970 --> 00:31:16,340

>> ANY QUESTIONS AT HOPE, USE
#ASKNASA.

500

00:31:16,340 --> 00:31:20,489

>> THIS IS INTRIGUING THIS IDEA
OF IMPLANTS FOR DRUG

501

00:31:20,489 --> 00:31:21,879

DISTRIBUTION.

502

00:31:21,879 --> 00:31:28,460

ARE THERE EITHER DRUGS OR
CONDITIONS AS FAR AS SCIENTISTS

503

00:31:28,460 --> 00:31:33,649

KNOW NOW THAT WOULD BE
APPROPRIATE FOR THIS SORT OF

504

00:31:33,649 --> 00:31:34,849
DRUG DELIVERY?

505
00:31:34,849 --> 00:31:35,849
>> YES.

506
00:31:35,849 --> 00:31:36,849
ABSOLUTELY.

507
00:31:36,849 --> 00:31:40,739
OBVIOUSLY THE IMPLANT WOULD
BE†-- WOULD REQUIRE A MINIMAL

508
00:31:40,739 --> 00:31:43,989
INVASIVE SURGERY LIKE A LITTLE
SURGERY CAN BE DONE IN

509
00:31:43,989 --> 00:31:45,950
OUTPATIENT PROCEDURE.

510
00:31:45,950 --> 00:31:50,379
BUT STILL IT REQUIRES TO BE
OPTIMAL IN TERMS OF THE BENEFIT

511
00:31:50,379 --> 00:31:51,389
TO THE PATIENTS.

512
00:31:51,389 --> 00:31:54,879
FOR THIS WE ARE TARGETED CHRONIC
PATHOLOGIES THAT REQUIRE DRUG

513
00:31:54,879 --> 00:31:59,059
ADMINISTRATION FOR PATIENT FOR
THE REST OF THEIR LIFE.

514
00:31:59,059 --> 00:32:04,379
ALL PATHOLOGIES REQUIRE
ADMINISTRATION OF DRUGS AGAIN

515

00:32:04,379 --> 00:32:05,839
MONTHS TO YEARS.

516
00:32:05,839 --> 00:32:08,950
THE IMPLANT THAT WE ARE
DEVELOPING ALLOWS FOR

517
00:32:08,950 --> 00:32:13,149
TRANSCUTANEOUSLY REFILLING THEM
WITHOUT NEED OF CHANGING THEM

518
00:32:13,149 --> 00:32:16,609
AFTER DRUG HAS BEEN COMPLETELY
EXHAUSTED.

519
00:32:16,609 --> 00:32:23,659
THEREFORE WE HOPE TO SEE ONE DAY
THIS TECHNOLOGY IN PEOPLE FOR,

520
00:32:23,659 --> 00:32:29,099
YOU KNOW, FOR LIFETIME KIND OF
APPLICATION WHEN NEEDED.

521
00:32:29,099 --> 00:32:34,779
WE ARE LOOKING FOR EXAMPLE
REPLACEMENT IS WITHIN OF THE

522
00:32:34,779 --> 00:32:37,799
ACTUAL APPLICATIONS.

523
00:32:37,799 --> 00:32:43,200
ONE OF CLASS EXAMPLES THAT I
BRING IS PEOPLE WITH

524
00:32:43,200 --> 00:32:46,669
HYPOTHYROIDISM THAT NEED TO TAKE
A PILL EVERY DAY FOR THE REST OF

525
00:32:46,669 --> 00:32:47,669
THEIR LIFE.

526

00:32:47,669 --> 00:32:54,119

WITH THIS SYSTEM, YOU HAVE THE
POTENTIAL OF HAVING IT DELIVERED

527

00:32:54,119 --> 00:32:58,710

INTO YOUR BODY AND FOR GETTING
ABOUT THE PILL WHICH REDUCES A

528

00:32:58,710 --> 00:33:03,549

LOT OF THE PROBLEM OF
COMPLIANCE.

529

00:33:03,549 --> 00:33:06,959

FOR EXAMPLE PROPHYLAXIS FOR HIV.

530

00:33:06,959 --> 00:33:11,929

WHERE YOU WANT THE TREATMENT IS
VERY IMPORTANT, SO YOU WANT TO

531

00:33:11,929 --> 00:33:15,960

HAVE A SYSTEM THAT CAN BE
DELIVERING THE DRUG FOR YOU SO

532

00:33:15,960 --> 00:33:22,519

THAT YOU DON'T†-- YOU MAY NOT
RUN INTO THE RISK OF GETTING

533

00:33:22,519 --> 00:33:24,769

INFECTED.

534

00:33:24,769 --> 00:33:35,190

>> LEWIS SHEPARD, PART OF THE
NASA SOCIAL GROUP.

535

00:33:35,190 --> 00:33:36,190

QUESTION FOR DR.

536

00:33:36,190 --> 00:33:38,809

ROBINSON BACK
ON THE JOURNALING AND OTHER

537

00:33:38,809 --> 00:33:42,440
EXPERIMENTS, THE 35 ON THIS
MISSION AND OTHERS.

538

00:33:42,440 --> 00:33:45,879
I WOULD IMAGINE THERE IS
DEVELOPING AN INCREASING NUMBER

539

00:33:45,879 --> 00:33:51,709
OF GRADUATE STUDENTS AND OTHER
SCIENTISTS WHO ARE WORKING IN

540

00:33:51,709 --> 00:33:56,099
THE VARIOUS FIELDS OF RESEARCH
AND SCIENTIFIC EXPLORATION THAT

541

00:33:56,099 --> 00:33:57,099
YOU DO.

542

00:33:57,099 --> 00:34:01,159
WHAT IS THE PIPELINE, DO YOU
HAVE A BACKLOG, A GROWING

543

00:34:01,159 --> 00:34:04,119
CHANNEL OF EXPERIMENTS, AND IF
SO, WHAT IS THE PROCESS FOR

544

00:34:04,119 --> 00:34:07,119
CHOOSING?

545

00:34:07,119 --> 00:34:08,730
>> IT'S A GREAT QUESTION.

546

00:34:08,730 --> 00:34:12,889
WE DO HAVE A BACKLOG OF
EXPERIMENTS PRIMARILY FOR THOSE

547

00:34:12,889 --> 00:34:15,090

EXPERIMENTS THAT NEED A LOT OF
CREW TIME.

548

00:34:15,090 --> 00:34:21,549

AUTOMATED EXPERIMENTS, WE IS
HAVE GREAT CAPACITY ON SpaceX.

549

00:34:21,549 --> 00:34:23,579

SO WE'RE ABLE TO GET THE
EXPERIMENTS UP WHEN WE'RE READY

550

00:34:23,579 --> 00:34:26,570

FOR THEM, BUT EXPERIMENTS THAT
DO TAKE A LOT OF CREW TIME NEED

551

00:34:26,570 --> 00:34:28,909

TO WAIT IN LINE.

552

00:34:28,909 --> 00:34:32,990

THE PRIORITIZATION PROCESS IS
BASICALLY CONGRESS TOLD US THAT

553

00:34:32,990 --> 00:34:37,450

WE NEED TO USE HALF OF OUR
RESOURCES FOR NASA'S EXPLORATION

554

00:34:37,450 --> 00:34:40,609

OBJECTIVES AND THE OTHER HALF
SHOULD BE FOR NATIONAL LAB FOR

555

00:34:40,609 --> 00:34:42,409

BENEFITS BACK HERE ON EARTH.

556

00:34:42,409 --> 00:34:44,320

SO WE MAKE THAT DIVISION.

557

00:34:44,320 --> 00:34:50,500

AND THEN CASIS PRIORITIZES BASED

ON THE ECONOMIC BENEFIT BACK

558

00:34:50,500 --> 00:34:54,679

HERE ON EARTH AND THAT'S HOW
THEY USE THAT 50% OF THE CREW

559

00:34:54,679 --> 00:34:55,679

TIME.

560

00:34:55,679 --> 00:35:00,539

AND THEN NASA, WE PRIORITIZE
BASED ON BASICALLY A COMPLEX

561

00:35:00,539 --> 00:35:03,410

SCHEMATIC THAT WE HAVE OF ALL
THE THINGS THAT WE HAVE TO DO TO

562

00:35:03,410 --> 00:35:06,730

BE READY TO LEAVE LOW EARTH
ORBIT.

563

00:35:06,730 --> 00:35:09,900

SO WE USE THE TECHNOLOGY
PRIORITIZATION AND OUR HUMAN

564

00:35:09,900 --> 00:35:13,160

RESEARCH PRIORITIZATION IS ALL
BASED ON WHAT THINGS WE NEED DO

565

00:35:13,160 --> 00:35:19,580

SO WE'LL BE READY TO GO TO MARS
EVENTUALLY.

566

00:35:19,580 --> 00:35:22,060

>> I'M ELIZABETH FROM SCIENCE
MUSEUM IN VANCOUVER AND WITH THE

567

00:35:22,060 --> 00:35:23,060

SOCIAL TEAM.

568

00:35:23,060 --> 00:35:26,029

I HAVE A QUESTION ABOUT THE
IMPLANTS.

569

00:35:26,029 --> 00:35:33,500

ARE THEY GOING TO BE HOSTED ON
ANIMALS AND IF SO WHAT KIND OF

570

00:35:33,500 --> 00:35:34,500

ANIMALS?

571

00:35:34,500 --> 00:35:38,940

>> DURING THIS EXPERIMENT, THIS
IS FOCUSED ENTIRELY ON BASIC

572

00:35:38,940 --> 00:35:44,440

SCIENCE OF THE TRANSPORT OF
MOLECULES.

573

00:35:44,440 --> 00:35:48,029

WE HAVE AN ADDITIONAL
EXPERIMENT, WE ARE DOING ANIMAL

574

00:35:48,029 --> 00:35:52,430

EXPERIMENT ON EARTH.

575

00:35:52,430 --> 00:35:57,069

WE ARE MOVING TO CLOSER TO
CLINICAL TESTING WITH REAL KIND

576

00:35:57,069 --> 00:35:58,180

OF APPLICATIONS.

577

00:35:58,180 --> 00:36:02,119

SO WE HAVE A SECOND EXPERIMENT
THAT WILL BE TESTED IN 2017 IS

578

00:36:02,119 --> 00:36:10,260

ACTUALLY IN THE LINE, THE

PIPELINE, 2017, IN RATS.

579

00:36:10,260 --> 00:36:16,990

AND THIS IS IN THE CONTEXT OF
BONE DENSITY LOSS AS WELL AS

580

00:36:16,990 --> 00:36:17,990

MUSCLE ATROPHY.

581

00:36:17,990 --> 00:36:23,640

AND THE EXPERIMENT HAS BEEN THAT
WE'RE WORK TOWARD HAS BEEN

582

00:36:23,640 --> 00:36:27,849

SUPPORTED BY CASIS.

583

00:36:27,849 --> 00:36:31,440

>> WE HAVE A QUESTION FROM
SOCIAL MEDIA ASKING HOW LONG

584

00:36:31,440 --> 00:36:34,829

DOES IT TAKE TO GROW THE VEGGIE
EXPERIMENT.

585

00:36:34,829 --> 00:36:39,859

>> SO THE PLANTS IN VEGGIE
REALLY TAKE THE SAME AMOUNT OF

586

00:36:39,859 --> 00:36:43,109

GROW, A LITTLE BIT SLOWER, BUT
ABOUT THE SAME TIME AS EARTH.

587

00:36:43,109 --> 00:36:48,500

SO TWO TO FOUR WEEKS DEFENDING
ON WHAT PLANT.

588

00:36:48,500 --> 00:36:51,910

>> AND LEWIS ON TWITTER ASKS IF
THERE IS ANY CONSIDERATION FOR

589

00:36:51,910 --> 00:36:55,040

FUTURE MISSIONS BEYOND A ONE
YEAR MISSION FOR EVEN LONGER

590

00:36:55,040 --> 00:36:56,500

STAYS ON ISS.

591

00:36:56,500 --> 00:37:01,160

>> WE ARE DEFINITELY TALKING
ABOUT FUTURE ONE YEAR MISSIONS

592

00:37:01,160 --> 00:37:04,910

AS WELL AS A VARIETY OF
DIFFERENT SCENARIOS FOR DOING

593

00:37:04,910 --> 00:37:09,990

DEEP SPACE MISSIONS SIMULATIONS
USING THE ISS.

594

00:37:09,990 --> 00:37:14,420

ONE THING WE NEED TO DO IS GET
SOME OF THE DATA BACK FROM THE

595

00:37:14,420 --> 00:37:18,930

FIRST SET OF ONE YEAR CREW
MEMBERS BECAUSE WE UNDERSTAND

596

00:37:18,930 --> 00:37:21,730

WHAT GOES ON IN A SIX MONTH
PERIOD PRETTY WELL.

597

00:37:21,730 --> 00:37:24,600

AND WHAT WE NEED TO SEE IS IF
THE 12 MONTH PERIOD IS WHAT WE

598

00:37:24,600 --> 00:37:27,839

PREDICT OR IF THERE IS SOME KIND
OF GOTCHA THERE WHERE SOMETHING

599

00:37:27,839 --> 00:37:30,750
IS SO DIFFERENT IN 12 MONTHS
THAT ALL OF A SUDDEN WE HAVE A

600
00:37:30,750 --> 00:37:32,740
NEW RISK THAT WE DIDN'T KNOW
ABOUT.

601
00:37:32,740 --> 00:37:34,700
AND THAT'S GOING TO REALLY
INFLUENCE THE FINAL DECISIONS

602
00:37:34,700 --> 00:37:38,069
THAT ARE MADE ABOUT ADDITIONAL
ONE YEAR MISSIONS.

603
00:37:38,069 --> 00:37:39,470
>> HI.

604
00:37:39,470 --> 00:37:45,900
ERIN SHARONI WITH NASA SOCIAL.

605
00:37:45,900 --> 00:37:49,220
YOU MENTIONED IT SOUNDED REALLY
INTERESTING STUDYING HOW SPACE

606
00:37:49,220 --> 00:37:52,460
FLIGHT AFFECTS GENETIC
EXPRESSION IN LIVING ORGANISMS.

607
00:37:52,460 --> 00:37:56,760
I'M CURIOUS ABOUT YOUR WORK WITH
THINGS THAT ARE LESS STATIC LOOK

608
00:37:56,760 --> 00:37:57,760
BLOOD.

609
00:37:57,760 --> 00:38:02,779
I'M ASSUMING YOU MONITOR BILE
MARKERS WHILE IN SPACE.

610

00:38:02,779 --> 00:38:06,450

HOW DO YOU OPTIMIZE THOSE THINGS
THAT ARE CONSTANTLY CHANGING I

611

00:38:06,450 --> 00:38:09,130

WOULD ASSUME?

612

00:38:09,130 --> 00:38:13,440

>> WHAT WE REALLY SEE ACROSS
ORGANISMS IS THAT THERE ARE†--

613

00:38:13,440 --> 00:38:17,420

THE ORGANISM REALLY RESPONDS TO
THE LACK OF THAT GRAVITY VECTOR.

614

00:38:17,420 --> 00:38:21,730

AND THAT CAN BE BECAUSE
CONVECTION ISN'T OPERATING IN

615

00:38:21,730 --> 00:38:26,990

THE SAME WAY, SOMETIMES IT CAN
BE BECAUSE IT SENSES GRAVITY AND

616

00:38:26,990 --> 00:38:27,990

CHANGES THE WAY THEY RESPOND.

617

00:38:27,990 --> 00:38:31,700

THAT IS TURNING OUT TO BE TRUE
IN SOME PLANT CELLS AS WELL AS

618

00:38:31,700 --> 00:38:32,869

ANIMAL CELLS.

619

00:38:32,869 --> 00:38:40,839

AND THEN THE FLUID SHIFTS.

620

00:38:40,839 --> 00:38:50,430

EACH ONE YOU CAN STUDY TO

UNDERSTAND WHAT IS GOING ON.

621

00:38:50,430 --> 00:38:54,329

SO THIS IS AN EXPERIMENT WE
CAN'T DO ANYWHERE ELSEWHERE WE

622

00:38:54,329 --> 00:39:03,869

INTRODUCE A CHALLENGE AND SEE
HOW IT RESPONDS.

623

00:39:03,869 --> 00:39:07,809

>> I'M WITH THE UTICA PHOENIX.

624

00:39:07,809 --> 00:39:11,119

MY QUESTION IS FOR THE
SUBCUTANEOUS IMPLANT.

625

00:39:11,119 --> 00:39:13,531

IS THERE ANY WORK BEING DONE FOR
THE SECURITY OF THE CHANNEL

626

00:39:13,531 --> 00:39:16,200

BEING TRANSMITTED TO AND FROM
THE IMPLANT?

627

00:39:16,200 --> 00:39:20,440

LIKE CAN THAT DATA BE OBSERVED
FROM AN OUTSIDE CHANNEL OR IS IT

628

00:39:20,440 --> 00:39:21,890

A SECURE LINE?

629

00:39:21,890 --> 00:39:25,720

>> WELL, THERE IS NO REAL WAY
FOR US TO LOOK INTO THE NANO

630

00:39:25,720 --> 00:39:26,839

CHANNELS REALLY.

631

00:39:26,839 --> 00:39:31,869
IT IS ACTUALLY VERY COMPLEX TO
DO IT WITH JUST ELECTRON MY

632
00:39:31,869 --> 00:39:35,990
CROSS POP CITY, EVEN TAKING A
MEMBRANE AND SECTIONS IT.

633
00:39:35,990 --> 00:39:39,819
WE'RE TALKING ABOUT NANO
CHANNELS DOWN TO 2.5 NANO

634
00:39:39,819 --> 00:39:40,819
METERS.

635
00:39:40,819 --> 00:39:43,560
SO REALLY DOWN TO THE LIMIT OF
THE TECHNOLOGY.

636
00:39:43,560 --> 00:39:50,609
SO WE USE TRANSMISSION OF
ELECTRO MICROSCOPY, BUT THERE IS

637
00:39:50,609 --> 00:39:57,130
NO WAY OF LOOKING AT AN ACTUAL
IMAGE THEY'RE TRANSPORTING.

638
00:39:57,130 --> 00:40:00,190
THAT'S WHY WE ARE REALLY
INTERESTED IN SCALING UP THE

639
00:40:00,190 --> 00:40:05,090
SYSTEM THREE ORDER OF MAGNITUDE
BECAUSE AT THAT POINT WE CAN

640
00:40:05,090 --> 00:40:11,089
REALLY USE A MICROSCOPY THE WAY
WE'LL DO RIGHT NOW AND TRACK THE

641
00:40:11,089 --> 00:40:15,869

MICRO PARTICLE DIFFUSING ALONG
THE CHANNELS SO THAT WE CAN

642

00:40:15,869 --> 00:40:16,869

RELY.

643

00:40:16,869 --> 00:40:18,640

>> CASEY AYERS.

644

00:40:18,640 --> 00:40:20,740

A QUESTION ABOUT THE VISION
TEST.

645

00:40:20,740 --> 00:40:24,140

YOU SAID THAT THERE IS A MACHINE
ON THE RUSSIA SIDE THAT ALLOWS

646

00:40:24,140 --> 00:40:28,279

FOR THE BLOOD TO BE SUCKED BACK
TOWARD THE BOTTOM OF THE

647

00:40:28,279 --> 00:40:30,440

ASTRONAUT'S BODIES IN ORDER TO
JUDGE WHAT EFFECT THAT MIGHT

648

00:40:30,440 --> 00:40:31,440

HAVE.

649

00:40:31,440 --> 00:40:33,289

CAN YOU EXPLAIN HOW THAT
MECHANISM WORKS AND WHAT THE

650

00:40:33,289 --> 00:40:35,660

THOUGHTS GO THROUGH FOR THAT
PARTICULAR PART OF THE

651

00:40:35,660 --> 00:40:36,660

EXPERIMENT?

652

00:40:36,660 --> 00:40:37,660

>> SURE.

653

00:40:37,660 --> 00:40:40,480

IS IT POSSIBLE TO SHOW A
PICTURE?

654

00:40:40,480 --> 00:40:43,310

I COMPLETELY FOR GOT TO TALK
ABOUT IT.

655

00:40:43,310 --> 00:40:45,380

BUT IT'S LOWER BODY NEGATIVE
PRESSURE.

656

00:40:45,380 --> 00:40:46,750

SO IT'S A VACUUM.

657

00:40:46,750 --> 00:40:49,630

YOU PUT YOUR FEET INTO THE SUIT,
YOU SEAL AT THE WAIST AND

658

00:40:49,630 --> 00:40:51,589

DECOMPRESS THE INSIDE OF THE
SUIT.

659

00:40:51,589 --> 00:40:55,029

SO IN ESSENCE YOU'RE TRAPPING
BLOOD IN THE LOWER BODY.

660

00:40:55,029 --> 00:40:58,510

AND YOU CONTROL THE VACUUM, HOW
MUCH BLOOD YOU'RE PULLING IN TO

661

00:40:58,510 --> 00:40:59,560

THE LOWER BODY.

662

00:40:59,560 --> 00:41:03,589

SO IF YOU USE SOMETHING LIKE 55
MERCURY THAT WOULD SIMULATE A

663

00:41:03,589 --> 00:41:09,780

FLUID TO THE FEET SIMILAR TO
WHAT YOU WOULD EXPECT ON EARTH.

664

00:41:09,780 --> 00:41:15,690

THE ONE ON STATION IS BLUE ABOUT
30 YEARS NEWER THAN THAT ONE.

665

00:41:15,690 --> 00:41:18,750

WE'RE USING A LOWER LEVEL.

666

00:41:18,750 --> 00:41:26,040

WE'LL BE DOING IT FOR ABOUT AN
HOUR TO COLLECT ALL THE DATA.

667

00:41:26,040 --> 00:41:30,990

WITH A HIGHER VACUUM LEVEL FOR A
LONGER PERIOD OF TIME, YOU WOULD

668

00:41:30,990 --> 00:41:32,650

EVENTUALLY PASS OUT.

669

00:41:32,650 --> 00:41:37,220

SO RUSSIANS USE TO STIMULATE THE
SYSTEM TWO TO THREE WEEKS PRIOR

670

00:41:37,220 --> 00:41:38,220

TO REENTRY.

671

00:41:38,220 --> 00:41:39,819

WE'RE USING IT A LITTLE BIT
DIFFERENTLY.

672

00:41:39,819 --> 00:41:42,800

>> ANYMORE QUESTIONS IN THE
ROOM?

673

00:41:42,800 --> 00:41:44,609

OKAY.

674

00:41:44,609 --> 00:41:49,470

WE'LL SHIFT OVER TO OUR NEXT
PANELISTS.

675

00:41:49,470 --> 00:41:53,250

THEY WILL TALK ABOUT A NEW
TECHNOLOGY LAUNCHED THAT COULD

676

00:41:53,250 --> 00:42:27,400

HAVE IMPLICATIONS FOR ASTRONAUTS
ABOARD

677

00:42:27,400 --> 00:42:45,730

THE INTERNATIONAL SPACE
STATION.

678

00:42:45,730 --> 00:43:04,670

\MM

>> JOINING US IS DR.

679

00:43:04,670 --> 00:43:08,549

JEFF

NORRIS, HE'S THE PROJECT LEAD IN

680

00:43:08,549 --> 00:43:10,940

PASADENA, CALIFORNIA.

681

00:43:10,940 --> 00:43:14,930

AND ALEX KIPMAN, MICROSOFT
TECHNICAL FELLOW.

682

00:43:14,930 --> 00:43:16,230

JEFF.

683

00:43:16,230 --> 00:43:20,220

>> AND IT'S REALLY A PLEASURE TO
BE HERE TODAY.

684

00:43:20,220 --> 00:43:25,900

I'M JEFF NORRIS AND I'M MISSION
OPERATIONS INNOVATIVE LEAD AND

685

00:43:25,900 --> 00:43:28,910

LEAD OF PROJECT SIDEKICK FOR OUR
SOCIAL MEDIA GUESTS.

686

00:43:28,910 --> 00:43:30,460

MY TWITTER HANDLE IS DR.

687

00:43:30,460 --> 00:43:31,740

JEFF
NORRIS.

688

00:43:31,740 --> 00:43:38,019

PROJECT SIDEKICK, ITS GOAL IS TO
EMPOWER ASTRONAUTS ON THE ISS

689

00:43:38,019 --> 00:43:40,790

WITH ASSISTANCE WHEN AND WHERE
THEY NEED IT.

690

00:43:40,790 --> 00:43:43,720

AND WE WANT TO DO THAT BY
CONNECTING THEM TO REMOTE

691

00:43:43,720 --> 00:43:47,509

EXPERTISE AND PROVIDING
SOMETHING LIKE A HOLE GRAPHIC

692

00:43:47,509 --> 00:43:52,050

INSTRUCTION MANUAL.

693

00:43:52,050 --> 00:43:55,720

THE CREW HAS A GREAT DEAL OF
WORK THAT THEY NEED GO DONE.

694

00:43:55,720 --> 00:44:00,579

SOME ASSOCIATED WITH THE
OPERATION, AND SOME ASSOCIATED

695

00:44:00,579 --> 00:44:04,440

WITH THE SCIENCE THAT IS GOING
ON ON BOARD THE SPACE STATION

696

00:44:04,440 --> 00:44:06,970

LIKE THE EXPERIMENTS YOU'VE BEEN
HEARING ABOUT TODAY.

697

00:44:06,970 --> 00:44:09,600

AND WE'RE HOPING THAT WITH
PROJECT SIDEKICK, WITH CAN HE

698

00:44:09,600 --> 00:44:13,900

FIND WAYS TO ACCELERATE AND
IMPROVE THE EFFICIENCY OF THE

699

00:44:13,900 --> 00:44:16,520

WORK THAT THEY'RE DOING IN BOTH
OF THOSE CATEGORIES.

700

00:44:16,520 --> 00:44:19,500

IN ORDER TO DO THAT, WE FORMED A
PARTNERSHIP WITH THE MICROSOFT

701

00:44:19,500 --> 00:44:23,309

COOPERATION USING THE MICROSOFT
HALO LIMBS DEVICE AND

702

00:44:23,309 --> 00:44:25,950

TECHNOLOGIES LIKE SKYPE.

703

00:44:25,950 --> 00:44:29,289

AS YOU SAW IN THAT VIDEO, WE'VE
BEEN HARD AT WORK FOR SOME TIME

704

00:44:29,289 --> 00:44:32,720

DEVELOPING THE PROJECT SIDEKICK

SYSTEM AND TESTING IT.

705

00:44:32,720 --> 00:44:36,390

THE VIDEO THERE WAS US TESTING
IT IN MICRO GRAVITY WITH THE

706

00:44:36,390 --> 00:44:39,839

HELP OF NASA'S REDUCED GRAVITY
OFFICE ON BOARD THE WEIGHTS WILL

707

00:44:39,839 --> 00:44:41,990

WONDER C-9 JET.

708

00:44:41,990 --> 00:44:45,799

AND WE'RE ALSO GOING TO BE
TESTING SIDEKICK IN NASA'S

709

00:44:45,799 --> 00:44:49,060

EXTREME ENVIRONMENT MISSION
OPERATIONS EXPERIMENTS WHICH IS

710

00:44:49,060 --> 00:44:53,150

AN UNDER SEA LABORATORY AND
ANALOG FOR THE SPACE STATION

711

00:44:53,150 --> 00:44:54,150

THIS JULY.

712

00:44:54,150 --> 00:44:58,400

AND THERE WE'RE HOPING TO LEARN
SOME THINGS ABOUT HOW SIDEKICK

713

00:44:58,400 --> 00:45:02,170

WORKS AND REALISTIC OPERATIONAL
SCENARIOS AND LEARN WHAT WE USE

714

00:45:02,170 --> 00:45:06,400

THERE TO GUIDE SOME OF OUR TESTS
ON BOARD THE SPACE STATION.

715

00:45:06,400 --> 00:45:08,920

AND I'M REALLY HAPPY TO BE
JOINED WITH MY COLLABORATOR ALEX

716

00:45:08,920 --> 00:45:12,450

KIPMAN WHO HAS BROUGHT WITH HIM
AN EXAMPLE OF THE DEVICE THAT

717

00:45:12,450 --> 00:45:15,869

WE'RE LAUNCHING TO THE SPACE
STATION THIS WEEKEND.

718

00:45:15,869 --> 00:45:17,240

>> THANK YOU, JEFF.

719

00:45:17,240 --> 00:45:18,240

GOOD MORNING.

720

00:45:18,240 --> 00:45:24,559

I'M REALLY EXCITED TO BE HERE
TODAY TO SHARE IN THIS MOMENT.

721

00:45:24,559 --> 00:45:27,990

NASA WAS THE FIRST EVER EXTERNAL
PARTNER FOR MICROSOFT THAT WE

722

00:45:27,990 --> 00:45:31,920

PARTNERED WITH TO DO ANYTHING ON
THE HOLO LENS.

723

00:45:31,920 --> 00:45:38,780

THIS IS THE FIRST FULLY
UNTETHERED HOLOGRAPHIC COMPUTER.

724

00:45:38,780 --> 00:45:47,450

THIS ALLOWS YOU TO MAKE THINGS
OUT OF LIGHT.

725

00:45:47,450 --> 00:45:53,619

WE CAN PLACE THESE HOLOGRAMS
RIGHT INTO YOUR LIFE WITH MORE

726

00:45:53,619 --> 00:45:55,789
REALITY THAN EVER BEFORE.

727

00:45:55,789 --> 00:46:00,559
NOW, THIS MIXED REALITY OF HAVE
HOLOGRAMS BEING IN THE REAL

728

00:46:00,559 --> 00:46:05,769
WORLD ALLOW YOU TO CREATE
EXPERIENCES THAT YOU HAVEN'T

729

00:46:05,769 --> 00:46:10,390
BEEN ABLE TO CREATE BEFORE ON
ANY OTHER DEVICE OR ANY OTHER

730

00:46:10,390 --> 00:46:11,390
PLATFORM.

731

00:46:11,390 --> 00:46:14,640
INCREDIBLY EXCITED TO HAVE
SIDEKICK BE ONE OF THOSE FIRST

732

00:46:14,640 --> 00:46:16,319
EXPERIENCES.

733

00:46:16,319 --> 00:46:21,080
>> AND JULIE, DO YOU WANT TO
TALK A LITTLE BIT ABOUT HOW

734

00:46:21,080 --> 00:46:23,190
THESE TYPE OF TECHNOLOGIES CAN
BENEFIT THE FOLKS ON THE

735

00:46:23,190 --> 00:46:25,009
INTERNATIONAL SPACE STATION?

736

00:46:25,009 --> 00:46:26,450

>> YES.

737

00:46:26,450 --> 00:46:28,670

IN THIS CASE, WE HAVE TWO
PURPOSES.

738

00:46:28,670 --> 00:46:31,630

ONE IS TO IMPROVE OUR OPERATIONS
EFFICIENCY AND IMPROVE THE WAY

739

00:46:31,630 --> 00:46:32,690

THAT WE WORK.

740

00:46:32,690 --> 00:46:35,779

AND DEVELOP WAYS TO DO MORE
COMPLEX OPERATIONAL TASKS.

741

00:46:35,779 --> 00:46:37,319

THAT BENEFITS US IN SPACE.

742

00:46:37,319 --> 00:46:40,509

BUT OF COURSE ANOTHER GOAL OF
THE SPACE STATION IS COMMERCIAL

743

00:46:40,509 --> 00:46:45,599

PARTNERSHIPS SO THAT WE CAN USE
THE EXTREME ENVIRONMENT OF SPACE

744

00:46:45,599 --> 00:46:50,410

FOR LIFE AND DEATH OPERATIONS TO
HELP BENEFIT AND CHANGE THE WAY

745

00:46:50,410 --> 00:46:52,549

THAT WE IMPLEMENT TECHNOLOGIES
ON EARTH.

746

00:46:52,549 --> 00:46:55,810

SO THERE IS A GREAT FEEDBACK
BACK AND FORTH BETWEEN A NUMBER

747

00:46:55,810 --> 00:46:59,660

OF THE TECHNOLOGIES THAT WE'RE
TESTING ON ISS AND THOSE BEING

748

00:46:59,660 --> 00:47:01,250

USED ON THE BACK.

749

00:47:01,250 --> 00:47:10,450

IT'S TRUE IN OUR ROBONAUT AND
DEFINITELY TRUE WITH SIDEKICK.

750

00:47:10,450 --> 00:47:13,420

>> TALK ABOUT THE VIDEO WE SAW.

751

00:47:13,420 --> 00:47:18,150

WHAT WERE THEY DOING THERE?

752

00:47:18,150 --> 00:47:23,980

>> THE TESTS WE PERFORMED ON THE
WEIGHTLESS WONDER WERE TO STUDY

753

00:47:23,980 --> 00:47:32,309

THE WAYS THAT SIDEKICK AND THE
HOLO LENS DEVICE FUNCTIONS.

754

00:47:32,309 --> 00:47:38,789

SO WE NEED TO MAKE SURE THAT IT
PERFORMED AS WE WOULD EXPECT

755

00:47:38,789 --> 00:47:39,960

THEM TO PERFORM ON BOARD.

756

00:47:39,960 --> 00:47:41,950

AND THE TESTS WENT EXTREMELY
WELL.

757

00:47:41,950 --> 00:47:45,780

AND WE'RE VERY POSITIVE ABOUT

THE EXPECTED PERFORMANCE OF THE

758

00:47:45,780 --> 00:47:47,160

DEVICE ON BOARD.

759

00:47:47,160 --> 00:47:51,970

>> WE'LL NOW TAKE QUESTIONS FROM
THE AUDIENCE.

760

00:47:51,970 --> 00:47:56,049

FRONT ROW.

761

00:47:56,049 --> 00:48:01,150

>> JIM SIEGEL WITH CELEBRATION
NEWS AND SPACE FLIGHT INSIDER.

762

00:48:01,150 --> 00:48:02,869

VERY INTRIGUING.

763

00:48:02,869 --> 00:48:05,990

DO I UNDERSTAND CORRECTLY THAT
THAT PIECE OF HEAD GEAR IS KIND

764

00:48:05,990 --> 00:48:11,600

OF A VIRTUAL REALITY IN WHICH
YOU WOULD PUT THE ASTRONAUTS IN

765

00:48:11,600 --> 00:48:15,700

VARIOUS SITUATIONS AND LET THEM
INTERACT WITH SOMETHING?

766

00:48:15,700 --> 00:48:20,530

I'M NOT EVEN SURE I UNDERSTAND
EXACTLY HOW THAT WOULD WORK OR

767

00:48:20,530 --> 00:48:21,530

THE PURPOSE.

768

00:48:21,530 --> 00:48:23,859

YOU CAN GIVE US SPECIFIC
EXAMPLES OF SCENARIOS?

769

00:48:23,859 --> 00:48:24,859

>> ABSOLUTELY.

770

00:48:24,859 --> 00:48:28,779

THIS IS A MIXED REALITY DEVICE.

771

00:48:28,779 --> 00:48:32,170

SO VERY DIFFERENT FROM A VIRTUAL
REALITY DEVICE.

772

00:48:32,170 --> 00:48:39,519

VIRTUAL REALITY
TAKES YOU INTO A VERY IMMERSIVE

773

00:48:39,519 --> 00:48:40,970

DIGITAL EXPERIENCE.

774

00:48:40,970 --> 00:48:43,099

WHEREBY YOU DON'T SEE THE WORLD
AROUND YOU.

775

00:48:43,099 --> 00:48:44,700

YOU DON'T SEE THE PEOPLE AROUND
YOU.

776

00:48:44,700 --> 00:48:49,359

AND YOU'RE HIGHLY IMMERSED IN A
DIGITAL EXPERIENCE.

777

00:48:49,359 --> 00:48:53,829

THESE IT'S HARD MAYBE TO SEE,
THESE ARE SEE-THROUGH.

778

00:48:53,829 --> 00:48:55,470

THEY'RE LIKE A PAIR OF GLASSES.

779

00:48:55,470 --> 00:48:58,160
YOU SEE THE WORLD AROUND YOU,
YOU SEE THE PEOPLE AROUND YOU.

780
00:48:58,160 --> 00:49:00,650
AND YOU CAN INTERACT WITH THEM
MUCH LIKE YOU WOULD IF YOU

781
00:49:00,650 --> 00:49:02,380
WEREN'T WEARING ANYTHING.

782
00:49:02,380 --> 00:49:07,269
THE DEVICE ALLOWS YOU TO THEN
PLAY DIGITAL ASSETS.

783
00:49:07,269 --> 00:49:11,500
RIGHT IN THE CONTEXT OF THE
WORLD AROUND YOU.

784
00:49:11,500 --> 00:49:14,160
SO FROM AN EXPERIENCES
PERSPECTIVE, YOU CAN IMAGINE IF

785
00:49:14,160 --> 00:49:18,630
YOU'RE TRYING TO DOCK SOMETHING
ON THE SPACE STATION OR GO

786
00:49:18,630 --> 00:49:21,060
THROUGH ANY NUMBER OF
PROCEDURES, YOU'RE ABLE TO NOW

787
00:49:21,060 --> 00:49:26,200
SEE DIGITAL ASSETS RIGHT OVER
THE ACTUAL OBJECTS YOU'RE TRYING

788
00:49:26,200 --> 00:49:27,369
TO INTERACT WITH.

789
00:49:27,369 --> 00:49:29,339
IN THE CONTEXT OF THE REAL

WORLD.

790

00:49:29,339 --> 00:49:31,839

THIS DEVICE IS CAPABLE OF
UNDERSTANDING THE ENVIRONMENT

791

00:49:31,839 --> 00:49:34,730

YOU'RE IN, ALSO CAPABLE OF
UNDERSTANDING THE PEOPLE AROUND

792

00:49:34,730 --> 00:49:38,599

YOU AND ABLE TO USE THAT
INFORMATION TO ALLOW YOU TO

793

00:49:38,599 --> 00:49:42,090

ESSENTIALLY PIN THESE
HOLOGRAPHIC ASSETS RIGHT IN THE

794

00:49:42,090 --> 00:49:43,090

WORLD.

795

00:49:43,090 --> 00:49:46,190

>> IF I COULD EXPAND ON THE
OPERATIONAL SIGNIFICANCE OF

796

00:49:46,190 --> 00:49:47,190

THAT.

797

00:49:47,190 --> 00:49:49,680

THERE ARE TWO OPERATIONAL MODES
THAT WE PLAN TO BE USING WITH

798

00:49:49,680 --> 00:49:51,400

SIDEKICK INITIALLY.

799

00:49:51,400 --> 00:49:54,619

ONE WE CALL REMOTE EXPERT MODE
IN WHICH WE ALLOW A GROUND

800

00:49:54,619 --> 00:50:00,260
CONTROLLER TO SEE THROUGH THE
EYES OF THE ASTRONAUT AND TO NOT

801
00:50:00,260 --> 00:50:04,150
ONLY SPEAK TO THE ASTRONAUT LIKE
IN A VIDEO CONFERENCE, BUT ALSO

802
00:50:04,150 --> 00:50:08,690
TO DRAW ANNOTATIONS DIRECTLY ON
TO THE WORLD THAT THE ASTRONAUT

803
00:50:08,690 --> 00:50:09,910
SEES IN FRONT OF HIM.

804
00:50:09,910 --> 00:50:14,249
SO YOU CAN IMAGINE THIS ALLOWING
US TO SAY FOR EXAMPLE TO TELL A

805
00:50:14,249 --> 00:50:19,670
CREW MEMBER TO PLEASE TURN THIS
SWITCH OR PUSH THIS BUTTON OR TO

806
00:50:19,670 --> 00:50:22,080
MOVE THIS OBJECT FROM ONE PLACE
TO ANOTHER.

807
00:50:22,080 --> 00:50:25,140
IT ALLOWS US TO CONNECT SOMEONE
WHO MIGHT BE THE LEADING EXPERT

808
00:50:25,140 --> 00:50:27,589
ON A PARTICULAR PIECE OF
EQUIPMENT OR SCIENTIFIC

809
00:50:27,589 --> 00:50:31,210
EXPERIMENT IN A WAY THAT THEY
CANNOT ONLY SPEAK TO THE

810
00:50:31,210 --> 00:50:34,549

ASTRONAUT BUT ALSO SHOW THEM
WHAT THEY WOULD LIKE THEM TO DO.

811

00:50:34,549 --> 00:50:38,211

AND IN THE SECOND MODE WE CALL
IT PROCEDURE MODE, THE ASTRONAUT

812

00:50:38,211 --> 00:50:40,950

WITHOUT HAVING A REMOTE
ASSISTANT IS ABLE TO SEE

813

00:50:40,950 --> 00:50:45,019

SOMETHING YOU MIGHT IMAGINE THAT
AN ANIMATED HOLOGRAM APPEARING

814

00:50:45,019 --> 00:50:48,579

ON TOP OF THE OBJECT THAT
THEY'RE BEING ASKED TO WORK ON.

815

00:50:48,579 --> 00:50:52,700

SO PERHAPS SHOWING THEM HOW TO
ASSEMBLE SOMETHING OR CHANGE THE

816

00:50:52,700 --> 00:50:57,619

CONFIGURATION OF SOMETHING FOR
AN EXPERIMENT.

817

00:50:57,619 --> 00:51:01,329

>> LAURA WHITTEN WITH NASA
SOCIAL.

818

00:51:01,329 --> 00:51:08,529

CAN YOU EXPAND ON HOW THIS
COLLABORATION IS WORKING AND

819

00:51:08,529 --> 00:51:11,779

WHAT NEW ADVANCEMENTS YOU'VE
MADE WITH IT?

820

00:51:11,779 --> 00:51:15,569

WHERE IT APPLIES TO
MANUFACTURING SAFETY IS MY

821

00:51:15,569 --> 00:51:17,810
UPPING IS ONE OF THE MAIN
APPLICATIONS.

822

00:51:17,810 --> 00:51:19,940
>> YOU'RE ASKING ABOUT THE
ROBONAUT?

823

00:51:19,940 --> 00:51:20,940
YES.

824

00:51:20,940 --> 00:51:25,980
IN THAT COLLABORATION, OF COURSE
WHAT NASA IS INTERESTED IN IS

825

00:51:25,980 --> 00:51:31,420
HOW TO USE A HUMANOID ROBOT SIDE
BY SIDE TO DO TESTS WITH THE

826

00:51:31,420 --> 00:51:34,289
ASTRONAUTS WITHOUT CAUSING
INJURY OR PROBLEMS.

827

00:51:34,289 --> 00:51:36,490
AND THEN EVENTUALLY WE'D LIKE TO
USE ROBONAUT TO DO MISSION

828

00:51:36,490 --> 00:51:46,569
CRITICAL TASKS THAT MIGHT BE TOO
A DANGEROUS

829

00:51:46,569 --> 00:51:49,290
SO WE CAN HAVE
HUMANS AND ROBOTS WORKING

830

00:51:49,290 --> 00:51:51,299
TOGETHER IN EXPLORATION.

831

00:51:51,299 --> 00:51:58,490

BUT ALL THE THINGS YOU NEED TO
DO TO USE ROBOTS IN SPACE DRIVES

832

00:51:58,490 --> 00:52:01,880

TECHNOLOGICAL INNOVATIONS THAT
YOU MIGHT NOT OTHERWISE DO BACK

833

00:52:01,880 --> 00:52:03,660

HERE ON EARTH.

834

00:52:03,660 --> 00:52:09,650

YOU'RE WILLING TO HAVE THINGS BE
BIG OR SLOW.

835

00:52:09,650 --> 00:52:13,470

AND THAT'S THE NATURE OF THE
COLLABORATION WHERE THERE IS A

836

00:52:13,470 --> 00:52:17,309

FEEDBACK BACK AND FORTH BETWEEN
THE INNOVATIONS THAT NASA DRIVES

837

00:52:17,309 --> 00:52:20,310

BECAUSE OF OUR TECHNOLOGICAL
NEEDS AND THEN TAKING THOSE

838

00:52:20,310 --> 00:52:24,099

INNOVATION AND INJECTING THEM
INTO THE USES OF ROBOTICS BACK

839

00:52:24,099 --> 00:52:28,429

HERE ON EARTH.

840

00:52:28,429 --> 00:52:32,680

>> MARK O HANNAH.

841

00:52:32,680 --> 00:52:35,569

FIRST OF ALL, HOW MANY HOURS IS
EXPECTED TO BE USED BY THE

842

00:52:35,569 --> 00:52:39,069

ASTRONAUTS OF HOLO LENS AND
WHERE IS IT GOING TO BE USED

843

00:52:39,069 --> 00:52:42,430

INSIDE THE INTERNATIONAL SPACE
STATION?

844

00:52:42,430 --> 00:52:47,420

>> SO WE'RE STILL FINALIZING
PLANS ON ALL OF THE PLACES AND

845

00:52:47,420 --> 00:52:49,529

SCENARIOS THAT WE EXPECT IT TO
BE USED IN.

846

00:52:49,529 --> 00:52:55,359

WE ARE LOOKING AT INITIAL TESTS
AND THEN OPERATIONAL USES.

847

00:52:55,359 --> 00:53:00,990

IT WON'T BE CONFINED TO A
SPECIFIC PART OF THE STATION.

848

00:53:00,990 --> 00:53:04,950

IT WILL WORK WHEREVER THE
ASTRONAUTS WOULD LIKE TO USE IT

849

00:53:04,950 --> 00:53:06,349

INSIDE THE SPACE STATION.

850

00:53:06,349 --> 00:53:11,599

AND WE'RE LOOKING AT A VARIETY
OF SYSTEMS RELATED OR YOU MIGHT

851

00:53:11,599 --> 00:53:15,789

THINK OF TASKS ASSOCIATED WITH

OPERATING THE STATION AS WELL AS

852

00:53:15,789 --> 00:53:21,279

SCIENTIFIC EXPERIMENTS WHERE IT
MIGHT BE AN ASSET TO THE CREW.

853

00:53:21,279 --> 00:53:26,339

>> HI, I'M CHRISTINE IN MORAN.

854

00:53:26,339 --> 00:53:29,320

FIRST QUESTION FOR ALL THE
PANELISTS.

855

00:53:29,320 --> 00:53:32,950

I'LL START OFF BY SAYING THIS
DEVICE LOOKS VERY COOL, VERY

856

00:53:32,950 --> 00:53:37,109

FUTURISTIC AND I'M EXCITED TO
SEE THE APPLICATIONS OF IT AND

857

00:53:37,109 --> 00:53:38,210

YOUR RESEARCH.

858

00:53:38,210 --> 00:53:41,970

I'M ALSO GOING TO ASK A MORE
ANTAGONISTIC QUESTION I GUESS.

859

00:53:41,970 --> 00:53:50,069

I RECENTLY TOOK PART IN A SpaceX
CHALLENGE AND WE FOUND THE

860

00:53:50,069 --> 00:53:57,549

ASTRONAUTS WERE USING A LARGE
PAPER SCRIPT.

861

00:53:57,549 --> 00:54:00,279

IT SEEMS LIKE A QUANTUM LEAP.

862

00:54:00,279 --> 00:54:03,799
IS THERE SOMETHING MORE
INTERMEDIATE GOING ON IN

863
00:54:03,799 --> 00:54:06,440
RESEARCH, MAYBE USING A
SMARTPHONE OR MAYBE SOMETHING

864
00:54:06,440 --> 00:54:13,089
MORE DOWN TO EARTH TO MAKE A
PUN?

865
00:54:13,089 --> 00:54:15,630
>> SO ASTRONAUTS TYPICALLY ARE
NOT USING PAPER ANY MORE.

866
00:54:15,630 --> 00:54:19,280
SO WHEN YOU SEE THE PAPER†--
VIDEOS WITH PAPER, THEY ARE FROM

867
00:54:19,280 --> 00:54:20,480
THE SHUTTLE ERA.

868
00:54:20,480 --> 00:54:23,170
THEY DO HAVE A PRINTER, BUT THEY
TRY NOT TO PRINT ANYTHING THEY

869
00:54:23,170 --> 00:54:25,390
DON'T NEED.

870
00:54:25,390 --> 00:54:32,420
SO WE DO HAVE AN UPGRADED SYSTEM
THAT HAS ALL THE PROCEDURES

871
00:54:32,420 --> 00:54:36,339
INTEGRATED, IT CAN BE USED IN AN
IPAD TYPE TOUCH SCREEN

872
00:54:36,339 --> 00:54:37,339
ENVIRONMENT.

873

00:54:37,339 --> 00:54:40,119

AND SO THE CREW MEMBERS CAN WORK
ALONG WITH THEMSELVES OFF OF

874

00:54:40,119 --> 00:54:41,290

THOSE DEVICES.

875

00:54:41,290 --> 00:54:44,299

SO WE DO HAVE THAT INTERMEDIATE
STEP.

876

00:54:44,299 --> 00:54:49,190

BUT CREW TIME IS INEFFICIENT
WHEN CREW MEMBERS HAVE TO GO

877

00:54:49,190 --> 00:54:53,239

BACK AND FORTH BETWEEN ANY KIND
OF REFERENCE AND THE TASK AT

878

00:54:53,239 --> 00:54:54,239

HAND.

879

00:54:54,239 --> 00:54:56,240

SO THAT IS ONE OF THE THINGS
THAT WE WILL LEARN FROM THIS

880

00:54:56,240 --> 00:55:01,859

STUDY.

881

00:55:01,859 --> 00:55:03,029

>> CASEY AYERS.

882

00:55:03,029 --> 00:55:04,910

TWO QUESTIONS.

883

00:55:04,910 --> 00:55:08,210

FIRST, WHAT HAVE YOU HAD TO
MODIFIED OR ADAPT FOR USE ON

884

00:55:08,210 --> 00:55:09,210

ORBIT?

885

00:55:09,210 --> 00:55:14,279

ANYTHING FROM THE ABILITY TO DO
HEAD TRACKING AND THAT SPACIAL

886

00:55:14,279 --> 00:55:18,210

PROGRAMMING AND THEN, TOO, HAVE
YOU LOOKED AT USING IT FOR EBA

887

00:55:18,210 --> 00:55:23,010

OR IS THE FOCUS EXCLUSIVELY
WITHIN THE STATION AT THIS POINT

888

00:55:23,010 --> 00:55:24,369

IN TIME?

889

00:55:24,369 --> 00:55:29,970

>> I'LL TAKE THE FIRST QUESTION
AND YOU CAN TAKE THE SECOND ONE.

890

00:55:29,970 --> 00:55:34,839

HAS A MYRIAD OF SENSORS THAT
UNDERSTAND THE WORLD AROUND YOU.

891

00:55:34,839 --> 00:55:40,250

UNDERSTANDING WHERE THE HUMAN IS
IN RELATION TO THE ENVIRONMENT

892

00:55:40,250 --> 00:55:45,140

AND AS WELL AS UNDERSTANDING
GESTURES.

893

00:55:45,140 --> 00:55:48,980

MOST OF THESE THINGS PRIMARILY
EXPECT TO BE ON EARTH OR THERE

894

00:55:48,980 --> 00:55:53,480
IS GRAVITY WHERE YOU CAN BE
TAKING CALCULATIONS IN REAL TIME

895
00:55:53,480 --> 00:55:57,450
ABOUT DIFFERENTIALS OF PERSONS
MOVING THROUGHOUT ENVIRONMENT

896
00:55:57,450 --> 00:55:59,730
YOU'RE TRYING TO UNDERSTAND IN
REAL TIME.

897
00:55:59,730 --> 00:56:04,369
NOW, THE SYSTEM INSIDE OF IT IS
A VERY SOPHISTICATED SYSTEM.

898
00:56:04,369 --> 00:56:07,980
IT RUNS THROUGH SOME SPECIAL
SILICON WE CREATED FOR IT, THE

899
00:56:07,980 --> 00:56:10,589
HOLE GRAPHIC PROCESSING UNIT.

900
00:56:10,589 --> 00:56:13,839
IT HAS ESSENTIALLY THREE CORE
PROCESSORS.

901
00:56:13,839 --> 00:56:19,019
A TRADITIONAL CPU, TRADITIONAL
GPU AND BRAND NEW CORE PROCESSOR

902
00:56:19,019 --> 00:56:22,359
THAT DOES ALL OF THOSE SENSOR
UNDERSTANDING OF THE WORLD THAT

903
00:56:22,359 --> 00:56:24,589
WE CALL OUR HOLOGRAPHIC
PROCESSING UNIT.

904
00:56:24,589 --> 00:56:28,920

NOW, THE SPACE OF IT THAT
HANDLES THE UNDERSTANDING OF THE

905

00:56:28,920 --> 00:56:32,660

ENVIRONMENT AND BEING ABLE TO
UNDERSTAND FROM BOTH AN INPUT

906

00:56:32,660 --> 00:56:36,710

AND OUTPUT PERSPECTIVE WORKS
FAIRLY SIMILAR TO HOW YOUR BRAIN

907

00:56:36,710 --> 00:56:37,930

WORKS.

908

00:56:37,930 --> 00:56:40,789

WE HAVE A TON OF SENSORS IN OUR
BODIES.

909

00:56:40,789 --> 00:56:43,119

ALL OF THOSE SENSORS ARE GOING
INTO YOUR BRAIN.

910

00:56:43,119 --> 00:56:47,740

AND THEN YOUR BRAIN FIGURES OUT
VERY SOPHISTICATED WAY WHAT IT

911

00:56:47,740 --> 00:56:50,100

SHOULD BE PAYING ATTENTION TO AT
ANY POINT IN TIME AND WHAT IT

912

00:56:50,100 --> 00:56:52,730

SHOULD NOT BE PAYING ATTENTION
TO AT ANY POINT IN TIME.

913

00:56:52,730 --> 00:57:01,299

IN SOFTWARE LAND, WE CALL THAT A
VERY SOPHISTICATED FILTER.

914

00:57:01,299 --> 00:57:10,249

ON EARTH WITH ESSENTIALLY METER

DATA COMING IN FROM THE INERTIAL

915

00:57:10,249 --> 00:57:11,700
MEASUREMENT UNIT.

916

00:57:11,700 --> 00:57:16,190
WHEN YOU PUT THIS IN A MICRO
GRAVITY OR ZERO G ENVIRONMENT,

917

00:57:16,190 --> 00:57:26,259
YOU SHOULD EXPECT THE SIGNAL TO
NOT BEHAVING CORRECTLY.

918

00:57:26,259 --> 00:57:29,320
WE WEREN'T SURE HOW THE HOLO
LENS WERE GOING TO HANDLE MICRO

919

00:57:29,320 --> 00:57:34,309
GRAVITY AND WE WERE PREPARED TO
CHANGE IT.

920

00:57:34,309 --> 00:57:44,200
THE EXPERIMENT WAS TO FIND OUT
HOW GOOD IS IT.

921

00:57:44,200 --> 00:57:47,100
LIKE YOUR BRAIN, IT ADJUSTS AND
STOPS PAYING ATTENTION TO THE

922

00:57:47,100 --> 00:57:50,200
FACT THAT THERE IS NO GRAVITY
AND STARTS PAYING ATTENTION TO

923

00:57:50,200 --> 00:57:59,619
THE AUDIO VISUAL CORTEXES.

924

00:57:59,619 --> 00:58:05,609
WE TOOK A TON OF DATA, RAN I
THINK 45 EXPERIMENTS THAT JUST

925

00:58:05,609 --> 00:58:07,829

HAD TO DO WITH THE ENVIRONMENT
UNDERSTANDING.

926

00:58:07,829 --> 00:58:12,690

WE BROUGHT IT BACK TO EARTH AND
I'M HAPPY TO SAY WE DID NOT HAVE

927

00:58:12,690 --> 00:58:17,859

TO CHANGE TO MAKE IT WORK IN
MICRO GRAVITY SCENARIOS.

928

00:58:17,859 --> 00:58:21,340

AND PART OF THE EXERCISE RIGHT
NOW IS TO SHIFT UP INTO SPACE

929

00:58:21,340 --> 00:58:23,320

AND RUN MORE EXPERIMENTS.

930

00:58:23,320 --> 00:58:29,310

SO SO FAR THE BRAIN WORKS BOTH
ON THE PLANET AND OUTSIDE OF IT,

931

00:58:29,310 --> 00:58:36,170

BUT WE'RE ALSO PREPARED TO
CHANGE IT TO MAKE IT WORK.

932

00:58:36,170 --> 00:58:41,259

>> YOUR SECOND QUESTION, ALL OF
THE INITIAL FOCUS IS FOCUSED ON

933

00:58:41,259 --> 00:58:46,609

INSIDE THE INTERNATIONAL STATION
SPACE, BUT I THINK THE POTENTIAL

934

00:58:46,609 --> 00:58:49,790

IS TO EXTEND BEYOND THAT AND WE
WILL BE LOOK FORWARD TO THOSE

935

00:58:49,790 --> 00:58:53,759
DIRECTIONS IN THE FUTURE.

936
00:58:53,759 --> 00:58:56,470
>> I'M MARK JOHNSON AT NASA
SOCIAL.

937
00:58:56,470 --> 00:59:00,790
AND I THINK IT'S SO COOL THAT WE
CAN HAVE PEOPLE ON THE GROUND

938
00:59:00,790 --> 00:59:03,519
COLLABORATE WITH PEOPLE IN THE
SKY.

939
00:59:03,519 --> 00:59:06,670
BUT I CAN IMAGINE THIS ALSO
BEING USED FOR NASA TEAMS THAT

940
00:59:06,670 --> 00:59:09,130
ARE JUST ON THE PLANET TO WORK
TOGETHER.

941
00:59:09,130 --> 00:59:12,960
HAVE YOU STARTED TO DO
EXPERIMENTS HERE ON THE GROUND?

942
00:59:12,960 --> 00:59:15,970
>> AS PART OF THE DEVELOPMENT OF
THIS PROJECT, WE'VE DONE A LOT

943
00:59:15,970 --> 00:59:19,680
OF ON-EARTH EXPERIMENTS AND
TRAINING WITH CREW.

944
00:59:19,680 --> 00:59:23,470
AND I'LL ALWAYS AHEAD TO THAT
THAT I THINK THERE ARE BENEFITS

945
00:59:23,470 --> 00:59:28,099

BEYOND THE SPACE PROGRAM OF
THESE KINDS OF TECHNOLOGICAL

946

00:59:28,099 --> 00:59:29,509

DEVELOPMENTS AND RESEARCH.

947

00:59:29,509 --> 00:59:32,509

THERE ARE A LOT OF PEOPLE ON
EARTH WHO HAVE TO PERFORM VERY

948

00:59:32,509 --> 00:59:36,029

COMPLICATED TASKS AND VERY LIFE
CRITICAL SCENARIOS.

949

00:59:36,029 --> 00:59:38,140

MEDICINE IS ONE THAT COMES TO
MIND.

950

00:59:38,140 --> 00:59:41,460

AND I HOPE THE THINGS WE'RE
LEARNING THROUGH PROJECT

951

00:59:41,460 --> 00:59:45,919

SIDEKICK WILL BENEFIT THOSE
APPLICATIONS, AS WELL.

952

00:59:45,919 --> 00:59:47,549

>> THANK.

953

00:59:47,549 --> 00:59:48,880

FOR THOSE AT HOME, USE #ASKNASA.

954

00:59:48,880 --> 00:59:51,480

I HAVE ONE FOR JEFF.

955

00:59:51,480 --> 00:59:56,420

I KNOW YOU WORK AT THE JET
PROPULSION LABORATORY.

956

00:59:56,420 --> 00:59:58,980
IS THERE ANY APPLICATION FOR
MARS RESEARCH?

957
00:59:58,980 --> 01:00:03,130
I KNOW WE GET FOOTAGE FROM THE
ROVER.

958
01:00:03,130 --> 01:00:05,839
ANYTHING THAT IS USE CASE THERE?

959
01:00:05,839 --> 01:00:08,099
>> THANK YOU.

960
01:00:08,099 --> 01:00:11,819
YEAH, COLLABORATION THAT WE HAVE
WITH MICROSOFT INCORPORATES

961
01:00:11,819 --> 01:00:16,250
ANOTHER APPLICATION THAT WE'VE
ANNOUNCED BACK IN JANUARY.

962
01:00:16,250 --> 01:00:17,250
ON SITE.

963
01:00:17,250 --> 01:00:20,809
AND WITH THE ON SITE PROJECT,
OUR GOAL IS TO CONNECT THE

964
01:00:20,809 --> 01:00:23,829
SCIENTISTS AND ENGINEERS WHO ARE
HELPING TO OPERATE THE CURIOSITY

965
01:00:23,829 --> 01:00:27,660
MARS ROVER WITH THE ENVIRONMENT
OF THE ROVER ON MARS.

966
01:00:27,660 --> 01:00:32,380
AND SO THOSE SIGN TEST AND
ENGINEERS CAN VIRTUALLY WORK

967

01:00:32,380 --> 01:00:36,900

TOGETHER ON MARS ALONGSIDE THE
ROVER THAT IS PERFORMING THE

968

01:00:36,900 --> 01:00:38,741

EXPERIMENTS AND THE EXPLORATION
THERE.

969

01:00:38,741 --> 01:00:42,960

AND REALLY THE FACT THAT WE HAVE
THESE TWO EFFORTS NOW UNDER WAY

970

01:00:42,960 --> 01:00:45,820

WITH MIXED REALITY WITHIN THE
AGENCY I THINK IT'S ALSO JUST A

971

01:00:45,820 --> 01:00:49,540

SIGN THAT THE POTENTIAL OF THIS
TECHNOLOGY IS SOMETHING THAT

972

01:00:49,540 --> 01:00:54,059

WE'RE EXCITED ABOUT AND WE
EXPECT MANY APPLICATIONS OF

973

01:00:54,059 --> 01:01:02,729

THESE MIXED REALITIES TO THE
AGENCY'S WORK AND BEYOND.

974

01:01:02,729 --> 01:01:06,039

>> COULD YOU DEMONSTRATE THE
GLASSES, PLEASE?

975

01:01:06,039 --> 01:01:09,480

>> THESE ACTUALLY I'M NOT GOING
TO HERE.

976

01:01:09,480 --> 01:01:10,630

THESE ARE MY PERSONAL PAIR.

977

01:01:10,630 --> 01:01:11,790

I JUST BROUGHT THEM.

978

01:01:11,790 --> 01:01:13,640

THEY'RE THE LATEST AND GREATEST.

979

01:01:13,640 --> 01:01:17,859

AND RIGHT HERE ON THE STAGE,
RIGHT NOW, NO, THANK YOU.

980

01:01:17,859 --> 01:01:22,680

>> IF YOU HAVE A QUESTIONS,
RAISE YOUR HAND.

981

01:01:22,680 --> 01:01:27,690

JULIE, ARE THERE ANY
IMPLICATIONS OUT IN SPACE?

982

01:01:27,690 --> 01:01:31,670

CAN IT BE HARMFUL TO THE EYES?

983

01:01:31,670 --> 01:01:37,249

>> I THINK FATIGUE IS A GOOD
QUESTION.

984

01:01:37,249 --> 01:01:40,609

BECAUSE I THINK ALL OF US HAVE
FOUND BOTH OUR EYES AND OUR

985

01:01:40,609 --> 01:01:43,869

WRISTS STRESS BY USING OUR
DEVICES TOO MUCH BACK HERE ON

986

01:01:43,869 --> 01:01:46,670

EARTH AND YOU HAD EXPECT THE
SAME KINDS OF CHALLENGES TO

987

01:01:46,670 --> 01:01:48,650

AFFECT ASTRONAUTS.

988

01:01:48,650 --> 01:01:52,560

ALSO THAT'S ONE OF THE REASONS
WHY GETTING TO TEST THIS IN AN

989

01:01:52,560 --> 01:01:57,069

OPERATIONAL ENVIRONMENT IS
IMPORTANT TO SEE HOW THAT WORKS.

990

01:01:57,069 --> 01:02:02,690

THE CREW WILL PROVIDED A LOT OF
FEEDBACK ABOUT HOW IT FELT TO

991

01:02:02,690 --> 01:02:04,710

USE IT, HOW WAS IT DIFFERENT
THAN WHAT THEY DID DURING

992

01:02:04,710 --> 01:02:07,460

TRAINING AND WHETHER OR NOT THEY
THIS THINK THIS WOULD BE HELPFUL

993

01:02:07,460 --> 01:02:08,680

OVER THE LONGER TERM.

994

01:02:08,680 --> 01:02:13,539

>> AND I'LL ADD AS PART OF THE
CERTIFICATION OF THE DEVICE FOR

995

01:02:13,539 --> 01:02:17,670

LAUNCH TO THE SPACE STATION, WE
COLLABORATED WITH THE DOCTORS

996

01:02:17,670 --> 01:02:21,239

AND OTHER SAFETY OFFICERS WHO
ARE RESPONSIBLE FOR MAKING SURE

997

01:02:21,239 --> 01:02:25,430

THAT THESE THINGS ARE SAFE FOR
THE CREW TO EXPERIMENT WITH ON

998

01:02:25,430 --> 01:02:29,869

ORBIT AND THOSE INITIAL TESTS
HERE GIVE US A LOT OF HOPE THAT

999

01:02:29,869 --> 01:02:33,079

IT WILL BE SOMETHING THAT THEY
CAN USE ON BOARD AND THEN WE

1000

01:02:33,079 --> 01:02:35,329

HOPE TO LEARN EVEN MORE ON
BOARD.

1001

01:02:35,329 --> 01:02:38,500

>> I'LL JUST ADD ONE LAST BIT TO
THAT, WHICH IS THIS IS A

1002

01:02:38,500 --> 01:02:40,299

CONSUMER PRODUCT.

1003

01:02:40,299 --> 01:02:42,900

AT THE END OF THE DAY, YOU MAY
JUST USE IT FOR SEVERAL HOURS A

1004

01:02:42,900 --> 01:02:47,220

DAY MANY DAYS OF THE WEEK AND
CHILDREN AND ADULTS ALIKE ON

1005

01:02:47,220 --> 01:02:48,220

EARTH.

1006

01:02:48,220 --> 01:02:51,019

AND FROM THAT PERSPECTIVE MAKING
SURE THAT PEOPLE ON EARTH DON'T

1007

01:02:51,019 --> 01:02:57,700

IT FATIGUE TOOK YEARS OF
DEVELOPMENT AT MICROSOFT.

1008

01:02:57,700 --> 01:03:02,670

SO THAT THEY CAN SEE AND
INTERACT WITH THE HOLOGRAMS FOR

1009

01:03:02,670 --> 01:03:08,329

MANY, MANY HOURS OF THE DAY
WITHOUT ANY DISCOMFORT.

1010

01:03:08,329 --> 01:03:14,559

>> I'M DAVID YANNO WITH NASA
SOCIAL.

1011

01:03:14,559 --> 01:03:18,269

YOU'VE MENTIONED THAT THE LENS
IS A MIXED REALITY DEVICE.

1012

01:03:18,269 --> 01:03:21,200

WE'VE HEARD THE TERM AUGMENTED
REALITY.

1013

01:03:21,200 --> 01:03:23,189

IS THERE A DIFFERENCE BETWEEN
BOTH?

1014

01:03:23,189 --> 01:03:24,189

>> YES.

1015

01:03:24,189 --> 01:03:25,599

A GREAT QUESTION.

1016

01:03:25,599 --> 01:03:28,490

THE SAME WAY THAT YOU CAN THINK
ABOUT VIRTUAL REALITY AS THE

1017

01:03:28,490 --> 01:03:30,859

IDEA THAT YOU DIDN'T SEE THE
REAL WORLD AND YOU'RE BEING

1018

01:03:30,859 --> 01:03:36,559

EXCEPTIONALLY TAKEN TO IMMERSIVE
DIGITAL ENVIRONMENT, AUGMENTED

1019

01:03:36,559 --> 01:03:43,279

REALITY IS THIS IDEA OF YOU MORE
OFTEN THAN NOT A PIECE IN FRONT

1020

01:03:43,279 --> 01:03:46,730

OF THE USER OR IN FRONT OF THE
PERSON WEARING OR LOOK THROUGH

1021

01:03:46,730 --> 01:03:49,150

THE DEVICE.

1022

01:03:49,150 --> 01:03:53,650

THE KEY DIFFERENCE OF MIXED
REALITY IS THAT THESE THINGS ARE

1023

01:03:53,650 --> 01:03:55,609

ACTUALLY PINNED TO THE REAL
WORLD.

1024

01:03:55,609 --> 01:04:00,430

THEY GET GRAFTED ON THE SURFACE
IN THE REAL WORLD AND YOU CAN

1025

01:04:00,430 --> 01:04:05,020

WALK AROUND IT.

1026

01:04:05,020 --> 01:04:08,261

SO THE IDEA THAT WE HAVE A
FUNDAMENTAL ENVIRONMENT AND

1027

01:04:08,261 --> 01:04:11,359

UNDERSTANDING WITH SPACIAL
MAPPING AND SPACIAL SOUND OF

1028

01:04:11,359 --> 01:04:14,579

THAT ENVIRONMENT AND THAT THE
OBJECTS JUST SIT THERE, THE

1029

01:04:14,579 --> 01:04:18,080
HOLOGRAPHIC OBJECTS, IS WHAT
SEPARATES THE TWO.

1030
01:04:18,080 --> 01:04:21,849
SO AUGMENT THE REALITY, IT MIGHT
BE JUST A CALL CARD WITH LIGHT

1031
01:04:21,849 --> 01:04:25,309
WEIGHT INFORMATION THAT MOVES
WITH THE HEAD OF THE PERSON.

1032
01:04:25,309 --> 01:04:29,690
WHEREAS HERE, YOU CAN LITERALLY
SEE YOUR LITTLE MINE CRAFT

1033
01:04:29,690 --> 01:04:32,530
CHARACTERS RUNNING ON TOP OF THE
TABLE AND YOU CAN MOVE AROUND

1034
01:04:32,530 --> 01:04:36,869
THE TABLE AND THEY WILL STILL
STAY WHERE THEY'RE SUPPOSED TO.

1035
01:04:36,869 --> 01:04:41,210
REALLY TAKING ADVANTAGE OF 50%
OF THE REAL WORLD, 50% OF THE

1036
01:04:41,210 --> 01:04:44,089
DIGITAL ASSETS WHICH IS WHERE
THE WORLD MIXED COMES IN.

1037
01:04:44,089 --> 01:04:53,509
THE REAL WORLD PLAYS JUST AS
MUCH INTO THE EXPERIENCE.

1038
01:04:53,509 --> 01:04:58,720
>> I'M ELIZABETH.

1039
01:04:58,720 --> 01:05:01,410

AND MY QUESTION IS ACTUALLY
ABOUT HOLOGRAMS EXACTLY WHAT IS

1040

01:05:01,410 --> 01:05:04,100
THIS SORT OF GOING TO LOOK LIKE
IF IT'S LIKE JUMPING AROUND ON

1041

01:05:04,100 --> 01:05:09,619
THE TABLE, LIKE WHAT IS THE
DISTANCE, WILL IT BE JUST LIKE

1042

01:05:09,619 --> 01:05:14,459
ON STAR WARS WHERE IT'S LIKE
FLASHING IN AND OUT?

1043

01:05:14,459 --> 01:05:17,660
>> THAT'S A GREAT QUESTION.

1044

01:05:17,660 --> 01:05:21,989
LOOK US UP ON TWITTER @SCIENCE
HOLO LENS.

1045

01:05:21,989 --> 01:05:25,799
THERE ARE TONS OF VIDEOS OUT
THERE FROM A LOT OF OUR

1046

01:05:25,799 --> 01:05:26,799
EXPERIENCES.

1047

01:05:26,799 --> 01:05:30,109
TO EQUATE TO THE STAR WARS
PRINCESS LEAH, THINK ABOUT THAT

1048

01:05:30,109 --> 01:05:35,400
AS BEING INTER-LACED BLUE.

1049

01:05:35,400 --> 01:05:39,420
THESE THINGS ARE SUPER HIGH
DEFINITION, FULL COLOR

1050
01:05:39,420 --> 01:05:43,450
HOLOGRAPHIC OBJECT IN THE REAL
WORLD.

1051
01:05:43,450 --> 01:05:46,509
YEAH, I WOULD SAY GO WATCH THE
VIDEOS.

1052
01:05:46,509 --> 01:05:49,589
IT'S THE CLEAREST EXAMPLE OF
WHAT IT FEELS LIKE.

1053
01:05:49,589 --> 01:05:50,890
THEY'RE SEE-THROUGH.

1054
01:05:50,890 --> 01:05:52,849
AT THE END OF THE DAY, WE'RE
ADDING PHOTONS TO THE BACK OF

1055
01:05:52,849 --> 01:05:55,640
YOUR EYE.

1056
01:05:55,640 --> 01:06:01,309
BLACK IS THE LACK OF LIGHT WHICH
MEANS TRANSLUCENT, BUT THEY FEEL

1057
01:06:01,309 --> 01:06:06,309
ANCHORED AND PINNED IN THE REAL
WORLD IN A VERY BELIEVABLE FORM.

1058
01:06:06,309 --> 01:06:09,819
AND YOU CAN HAVE LITTLE HUMANOID
CHARACTERS RUNNING AROUND, TGE

1059
01:06:09,819 --> 01:06:11,349
CHARACTERS RUNNING AWAY.

1060
01:06:11,349 --> 01:06:15,970
WE JUST CAME FROM ONE OF OUR

LATEST CONFERENCES WAS E-3 WHERE

1061

01:06:15,970 --> 01:06:19,290

GAMERS GO TO TALK ABOUT
ENTERTAINMENT FOR THE NEXT YEAR.

1062

01:06:19,290 --> 01:06:24,020

AND WE JUST SHOWCASED ONE OF OUR
KEY FRANCHISES MINE CRAFT IF YOU

1063

01:06:24,020 --> 01:06:26,749

HAVE KIDS YOU PROBABLY KNOW WHAT
IT IS.

1064

01:06:26,749 --> 01:06:30,239

AND WE SHOWCASE A VERSION OF
MINE CRAFT THAT IS HOLOGRAPHIC

1065

01:06:30,239 --> 01:06:35,109

WHERE YOU COULD SEE IT ON TOP OF
A TABLE AND INTERACT WITH YOUR

1066

01:06:35,109 --> 01:06:41,099

LITTLE CGI CHARACTERS ON TOP OF
A REAL WORLD TABLE.

1067

01:06:41,099 --> 01:06:45,910

SO FROM A PC, TABLET OR PHONE
AND INTERACT WITH YOU LIVE AND

1068

01:06:45,910 --> 01:06:48,960

IN COLOR ON TOP OF A HOLOGRAPHIC
TABLE WITH LITTLE MINE CRAFT

1069

01:06:48,960 --> 01:06:50,010

CHARACTERS.

1070

01:06:50,010 --> 01:06:55,650

>> THAT IS SO RADICAL.

1071

01:06:55,650 --> 01:06:58,109

IS THIS SOMETHING SPECIFIC THAT
YOU'RE WORRIED ABOUT NOT

1072

01:06:58,109 --> 01:06:59,109

WORKING?

1073

01:06:59,109 --> 01:07:03,269

I WORK WITH WEB DEVELOPMENT SO
I'M CURIOUS, IS THERE LIKE A

1074

01:07:03,269 --> 01:07:09,549

GLITCH OR A TICK THAT YOU'RE
NERVES IT WILL LIKE NOT MAKE IT?

1075

01:07:09,549 --> 01:07:11,749

>> THE PRODUCT IS STILL UNDER
DEVELOPMENT.

1076

01:07:11,749 --> 01:07:15,239

IT WILL COME OUT IN THE WINDOWS
10 TIME FRAME.

1077

01:07:15,239 --> 01:07:20,049

SO PEOPLE BACK AT HOME INCLUDING
MYSELF ARE PAID TO WORRY.

1078

01:07:20,049 --> 01:07:24,220

AND, YES, WE WORRY ABOUT THE
QUALITY OF THE PRODUCT AS WE

1079

01:07:24,220 --> 01:07:26,769

START GOING TOWARDS SHIP EVERY
DAY.

1080

01:07:26,769 --> 01:07:29,900

BUT THAT'S WHAT MAKES US GOOD
ENGINEERS.

1081

01:07:29,900 --> 01:07:32,390
I HAVE NO DOUBT TAKE IN THE
WINDOWS TIME FRAME YOU'LL GET AN

1082
01:07:32,390 --> 01:07:37,329
AMAZING PRODUCT THAT EVERYBODY
WILL LOVE.

1083
01:07:37,329 --> 01:07:38,329
>> A QUESTION QUICK FOR YOU.

1084
01:07:38,329 --> 01:07:39,329
SO YOU MENTIONED MINE CRAFT.

1085
01:07:39,329 --> 01:07:42,170
I'M SURE GAMERS ARE WONDERING
CAN SCOTT KELLY ON SPACE STATION

1086
01:07:42,170 --> 01:07:45,490
PLAY MINE CRAFT AND CAN WE PLAY
HOME GAMES WITH HIM?

1087
01:07:45,490 --> 01:07:53,990
>> PART OF THE REASON WHY WE'RE
TESTING PROJECT SIDEKICK IS WE

1088
01:07:53,990 --> 01:07:58,700
SEE THIS AS A PLATFORM.

1089
01:07:58,700 --> 01:08:03,999
THERE ARE THINGS LIKE TABLETS
AND LAB TOPS.

1090
01:08:03,999 --> 01:08:13,960
SO WE'RE STARTING WITH A COUPLE
PLATFORMS AND WE DO HAVE IDEAS

1091
01:08:13,960 --> 01:08:14,960
GOING BEYOND THAT.

1092

01:08:14,960 --> 01:08:16,549

AND THOSE DO INCLUDE ENTERTAIN.

1093

01:08:16,549 --> 01:08:21,360

AND THE MENTAL WELL-BEING OF THE
CREW WHILE THEY'RE ON BOARD.

1094

01:08:21,360 --> 01:08:27,650

SO WHILE WE DON'T HAVE A
SPECIFIC PLAN RIGHT NOW, IT IS

1095

01:08:27,650 --> 01:08:32,710

WITHIN OUR PLANS FOR HOW THIS
PLATFORM COULD BENEFIT THE CREW

1096

01:08:32,710 --> 01:08:34,779

IN THE FUTURE.

1097

01:08:34,779 --> 01:08:37,560

>> THIS BEAUTIFUL PRODUCT IS
RUNNING INSIDE OF IT, WINDOWS

1098

01:08:37,560 --> 01:08:38,560

10.

1099

01:08:38,560 --> 01:08:41,380

SO IT'S THE SAME VERSION OF
WINDOWS 10 THAT EVERYBODY WILL

1100

01:08:41,380 --> 01:08:43,960

GET ON JULY 29.

1101

01:08:43,960 --> 01:08:48,630

IT HAS THE SAME UNIVERSAL SEK
AND SAME UNIVERSAL STORE AS

1102

01:08:48,630 --> 01:08:51,650

EVERY OTHER INVESTIGATION OF
WINDOWS FROM THE LITTLE SCREENS

1103

01:08:51,650 --> 01:08:53,900

TO THE BIG SCREENS TO NO SCREENS
AT ALL.

1104

01:08:53,900 --> 01:09:02,310

WHICH MEANS THE PORTFOLIO IN THE
APP STORE WILL ALSO BE HERE.

1105

01:09:02,310 --> 01:09:06,900

THEY'RE CAPABLE OF BEING MANAGED
BY THE ENTERPRISE.

1106

01:09:06,900 --> 01:09:13,719

SO THEY CAN CHOOSE HOW MUCH TO
MAKE IT AVAILABLE FOR THE PEOPLE

1107

01:09:13,719 --> 01:09:18,270

WHO HAVE THE DEPLOYMENT OF THE
DEVICES.

1108

01:09:18,270 --> 01:09:24,650

I HOPE THE ASTRONAUTS DO PLAY
MINE CRAFT.

1109

01:09:24,650 --> 01:09:30,219

>> THIS IS PETER WRIGHT, NASA
SOCIAL.

1110

01:09:30,219 --> 01:09:34,449

#FRUGAL.

1111

01:09:34,449 --> 01:09:36,509

IF YOU HAVE LOW PERFORMANCE,
THAT CAN INDUCE NAUSEA AND

1112

01:09:36,509 --> 01:09:38,420

MOTION SICKNESS.

1113

01:09:38,420 --> 01:09:41,219
WE KNOW FROM OTHER PRESENTATIONS
THAT SOMETHING THE ASTRONAUTS

1114
01:09:41,219 --> 01:09:43,630
EXPERIENCE WHEN THEY FIRST
ARRIVE IN THE MICRO GRAVITY

1115
01:09:43,630 --> 01:09:46,659
ENVIRONMENT IS MOTION SICKNESS,
NAUSEA, DIZZINESS.

1116
01:09:46,659 --> 01:09:49,569
DOES THIS ADD FURTHER
COMPLICATIONS TO THAT?

1117
01:09:49,569 --> 01:09:50,569
>> IT DOES NOT.

1118
01:09:50,569 --> 01:09:51,569
A GREAT QUESTION.

1119
01:09:51,569 --> 01:09:57,780
THIS IS THE PART THAT I TRIED IT
ANSWER EARLIER TODAY.

1120
01:09:57,780 --> 01:10:01,740
WE HAVE SPANNED THE MAJORITY OF
THE DEVELOPMENT CYCLE TO MAKE

1121
01:10:01,740 --> 01:10:04,960
SURE ONCE YOU PUT IT OVER
SOMEONE'S HEAD, IT DOESN'T CAUSE

1122
01:10:04,960 --> 01:10:10,989
ANY DISCOMFORT.

1123
01:10:10,989 --> 01:10:15,210
ONE OF THE KEY ISSUES YOU HAVE
IN VIRTUAL REALITY LAND IS THAT

1124

01:10:15,210 --> 01:10:17,580

YOU'RE ACTUALLY REMOVING THE
ENTIRE WORLD.

1125

01:10:17,580 --> 01:10:20,739

ONCE YOU REMOVE THE ENTIRE
WORLD, UNLESS YOU GET EVERY

1126

01:10:20,739 --> 01:10:25,010

SINGLE ONE OF YOUR SENSES TO
WORK PRECISELY CORRECT, YOU END

1127

01:10:25,010 --> 01:10:27,050

UP CAUSING DISCOMFORT.

1128

01:10:27,050 --> 01:10:32,380

AT THE END OF THE DAY, YOUR BODY
IS THIS BEAUTIFUL ORGANISM THAT

1129

01:10:32,380 --> 01:10:36,489

SAYS MY SENSORS ALL COMING TO MY
BRAIN START DISAGREEING WITH

1130

01:10:36,489 --> 01:10:40,090

EACH OTHER, SOMETHING MUST BE
GOING ON.

1131

01:10:40,090 --> 01:10:45,550

FIRST YOU START YAWNING TO GET
MORE OXYGEN INSIDE MY BODY.

1132

01:10:45,550 --> 01:10:50,560

AND THEN YOU'LL START BURPING TO
TRY TO SEE IF THERE IS SOMETHING

1133

01:10:50,560 --> 01:10:51,560

THAT NEEDS TO COME OUT.

1134

01:10:51,560 --> 01:10:52,560
EVENTUALLY YOU THROW UP.

1135
01:10:52,560 --> 01:10:55,400
WHICH IS YOU'RE TRYING TO EXPEL
ANY POISON THAT YOU PUT INTO

1136
01:10:55,400 --> 01:10:56,400
YOUR BODY.

1137
01:10:56,400 --> 01:10:57,840
AND THIS IS NORMAL MECHANISM.

1138
01:10:57,840 --> 01:11:00,349
YOUR SENSORS ARE DISAGREEING
WITH EACH OTHER, EVENTUALLY YOU

1139
01:11:00,349 --> 01:11:02,210
THROW UP BECAUSE YOU'RE LIKELY
POISONED.

1140
01:11:02,210 --> 01:11:07,290
NOW, IF YOU'RE INSIDE A PAIR OF
THE GOGGLES, TO GET THINGS

1141
01:11:07,290 --> 01:11:12,050
PRECISELY CORRECT, YOU WILL GET
SOME AMOUNT OF SENSORS IN YOUR

1142
01:11:12,050 --> 01:11:13,570
BODY DISAGREEING WITH EACH
OTHER.

1143
01:11:13,570 --> 01:11:17,739
AND IT COULD CAUSE SOME AMOUNT
OF FATIGUE.

1144
01:11:17,739 --> 01:11:22,510
NOW, MY FRIENDS HAVE ALSO SPENT
A TREMENDOUS AMOUNT OF TIME

1145

01:11:22,510 --> 01:11:25,130
TRYING TO FIX ALL OF THESE
ISSUES AND EVEN IF YOU PLAYED

1146

01:11:25,130 --> 01:11:29,190
WITH SOME OCCULAR RISK IN THE
BEGINNING TO THE LATEST ONES IN

1147

01:11:29,190 --> 01:11:32,949
WILL SHIP NEXT YEAR, THEY HAVE
MADE TREMENDOUS PROGRESS IN

1148

01:11:32,949 --> 01:11:34,659
THOSE TYPES OF ISSUES.

1149

01:11:34,659 --> 01:11:45,320
IN THIS GUY, YOU ESSENTIALLY ARE
SEEING THE REAL WORLD.

1150

01:11:45,320 --> 01:11:49,030
YOUR EYES SEE THE REAL WORLD AS
IT IS, YOUR EARS HERE IT AS IT'S

1151

01:11:49,030 --> 01:11:52,090
SUPPOSED TO BE AND ULTIMATELY IT
STILL TALKS TO THE BACK OF YOUR

1152

01:11:52,090 --> 01:11:58,699
BRAIN OR INNER EAR THAT NEEDS TO
AGREE WITH YOUR OCCULAR SYSTEMS.

1153

01:11:58,699 --> 01:12:03,590
AND AT THE END OF DAY, HOLOGRAMS
ARE PLACED IN THE REAL WORLD.

1154

01:12:03,590 --> 01:12:07,010
THE WAY TO MAKE YOU NOT FATIGUED
IS GETTING THEM TO BE CORRECT IN

1155

01:12:07,010 --> 01:12:09,300

BOTH SPACE AND TIME.

1156

01:12:09,300 --> 01:12:12,280

FROM A SPACE PERSPECTIVE, YOU
WANT TO MAKE SURE THAT IF WE'RE

1157

01:12:12,280 --> 01:12:15,580

PAINTING THESE HOLOGRAMS, THIS
THEY'RE NOT FLICKERING.

1158

01:12:15,580 --> 01:12:20,429

IF THEY START DOING THAT, YOUR
BRAIN WILL SAY I MUST BE

1159

01:12:20,429 --> 01:12:23,020

POISONED, MAYBE I HAVE FATIGUE.

1160

01:12:23,020 --> 01:12:26,050

AND FROM A TIME PERSPECTIVE, YOU
WANT TO BE ABLE TO PAINT THESE

1161

01:12:26,050 --> 01:12:29,900

HOLOGRAMS AS THE SAME TYPE OF
TIME SLICES THAT YOU CAN

1162

01:12:29,900 --> 01:12:32,010

ACTUALLY PERCEIVE THE REAL
WORLD.

1163

01:12:32,010 --> 01:12:44,820

SO IN ONE YOU'RE THINKING MICRO
FRACTIONS OF MILIRADIUMS

1164

01:12:44,820 --> 01:12:46,989

OF
PRECISION.

1165

01:12:46,989 --> 01:12:50,280

IF YOU READ ABOUT IT IN PEOPLE
THAT HAVE EXPERIENCES, THE FIRST

1166

01:12:50,280 --> 01:12:55,030
THING THAT THEY SAY IS OH, MY
GOD, THE THING IS SO SOLID.

1167

01:12:55,030 --> 01:12:57,870
SO MUCH CORRECTLY PINNED IN THE
REAL WORLD.

1168

01:12:57,870 --> 01:13:02,150
THAT'S BECAUSE WE PLACE THEM IN
SPACE CORRECTLY.

1169

01:13:02,150 --> 01:13:08,010
AND YOU NEED TO BE ABLE TO DO IT
IF FREQUENCIES THAT ARE THINK

1170

01:13:08,010 --> 01:13:09,950
SINGLE DIGITS, MILLISECONDS.

1171

01:13:09,950 --> 01:13:17,219
IF IT TAKES YOU LONGER THAN THAT
TO CALCULATE THE ENTIRE

1172

01:13:17,219 --> 01:13:20,989
ENVIRONMENT AND REPROJECT, AGAIN
IT CAN CAUSE FATIGUE.

1173

01:13:20,989 --> 01:13:28,570
IT STABILIZES BOTH SPACE AND
TIME IN A WAY THAT NORMAL HUMANS

1174

01:13:28,570 --> 01:13:33,420
ON EARTH WON'T FATIGUE AND YOU
CAN EXPECT ASTRONAUTS,

1175

01:13:33,420 --> 01:13:35,440
SIGNIFICANTLY MORE WELL TO DO IN

THAT SPACE.

1176

01:13:35,440 --> 01:13:39,929

>> AND THIS HAS OPERATIONAL
SIGNIFICANCE FOR US, AS WELL.

1177

01:13:39,929 --> 01:13:43,320

WE NEED TO BE ABLE TO PLACE
THESE ANNOTATIONS IN THE

1178

01:13:43,320 --> 01:13:47,090

ENVIRONMENT OF THE ASTRONAUT IN
A STABLE FASHION SO THEY CAN BE

1179

01:13:47,090 --> 01:13:50,270

RELIED UPON FOR OPERATIONAL
INSTRUCTION.

1180

01:13:50,270 --> 01:13:53,550

TELLING THE CREW THE TASK THAT
WE NEED THEM TO ACCOMPLISH OR

1181

01:13:53,550 --> 01:13:56,429

HELPING THEM THROUGH A
COMPLICATED EXPERIMENT.

1182

01:13:56,429 --> 01:14:00,719

AND OF COURSE THE TESTING OF HOW
THE WEIGHTLESS ENVIRONMENT

1183

01:14:00,719 --> 01:14:03,610

INTERACTS WITH ALL THE
TECHNOLOGIES THAT ALEX WAS JUST

1184

01:14:03,610 --> 01:14:07,810

DESCRIBING BEGAN WITH OUR TESTS
ON BOARD THE C-9 JET AND THEY

1185

01:14:07,810 --> 01:14:08,810

WILL CONTINUE ON BOARD.

1186

01:14:08,810 --> 01:14:12,449

BUT SO FAR WE FEEL VERY POSITIVE ABOUT THAT.

1187

01:14:12,449 --> 01:14:15,040

>> WE HAVE A LITTLE BIT MORE TIME FOR QUESTIONS IF THERE ARE

1188

01:14:15,040 --> 01:14:16,179

SOME IN THE ROOM.

1189

01:14:16,179 --> 01:14:21,199

SOCIAL MEDIA, USE #ASKNASA.

1190

01:14:21,199 --> 01:14:22,650

YOU MENTIONED SKYPE.

1191

01:14:22,650 --> 01:14:26,400

CAN SCOTT KELLY ON SPACE STATION, CAN HE TALK TO HIS

1192

01:14:26,400 --> 01:14:29,580

FAMILY AND FRIENDS USING THE DEVICE?

1193

01:14:29,580 --> 01:14:31,170

>> GREAT QUESTION.

1194

01:14:31,170 --> 01:14:37,040

SCOTT KELLY IS OUR FIRST EXPECTED USER AND IT'S SOMETHING

1195

01:14:37,040 --> 01:14:41,880

THAT WHEN WE WERE TRAINING WITH SCOTT EARLIER ON, SOMETHING HE

1196

01:14:41,880 --> 01:14:44,810

BROUGHT UP AS AN AREA OF

INTEREST FOR HIM AND IT MAKES

1197

01:14:44,810 --> 01:14:50,150

PERFECT SENSE THAT A PERSON IN
AN EXTENDED STAY UP ON THE SPACE

1198

01:14:50,150 --> 01:14:54,050

STATION WOULD WANT NEW WAYS AND
MORE INTIMATE WAYS TO CONNECT

1199

01:14:54,050 --> 01:14:56,860

WITH THE PEOPLE THAT ARE HERE ON
EARTH.

1200

01:14:56,860 --> 01:15:00,960

SO WHILE WE HAVEN'T SCHEDULED A
SPECIFIC CALL TIME OR SOMETHING

1201

01:15:00,960 --> 01:15:04,721

LIKE THAT FOR SCOTT TO USE THE
DEVICE IN THAT WAY, IT'S

1202

01:15:04,721 --> 01:15:09,140

DEFINITELY SOMETHING THAT IS ON
OUR RADAR.

1203

01:15:09,140 --> 01:15:14,390

>> THIS IS A QUESTION FROM
TWITTER FOR DR.

1204

01:15:14,390 --> 01:15:16,380

ROBINSON.

1205

01:15:16,380 --> 01:15:20,630

WHAT KIND OF VEGETABLES ARE NOT
SUITABLE FOR SPACE TRAVEL?

1206

01:15:20,630 --> 01:15:22,750

>> A GOOD QUESTION.

1207

01:15:22,750 --> 01:15:26,560

BIGGEST PROBLEM WE HAD IS
VOLUME.

1208

01:15:26,560 --> 01:15:32,270

SO WE WANT TO GROW THINGS THAT
ARE PRETTY SMALL IN VOLUME.

1209

01:15:32,270 --> 01:15:35,320

AND THAT GROW PRETTY QUICKLY, AS
WELL.

1210

01:15:35,320 --> 01:15:38,650

WE ALSO HAVE LEARNED A LOT ABOUT
HOW PLANTS GROW IN SPACE AND

1211

01:15:38,650 --> 01:15:42,520

SOME PLANTS ARE MORE OR LESS
SENSITIVE TO NOT BEING GRAVITY

1212

01:15:42,520 --> 01:15:46,340

THERE OR MORE OR LESS SENSITIVE
TO WATER NOT BEHAVING IN THE

1213

01:15:46,340 --> 01:15:47,900

SAME WAY AS IT DOES HERE ON
EARTH.

1214

01:15:47,900 --> 01:15:51,750

SO YOU CAN IMAGINE YOU'VE SEEN
PICTURES OF ASTRONAUTS PLAYING

1215

01:15:51,750 --> 01:15:53,040

WITH WATER BUBBLES.

1216

01:15:53,040 --> 01:15:55,000

THAT'S WHAT IS HAPPENING IN THE
SOIL, AS WELL.

1217

01:15:55,000 --> 01:15:58,060

WATER IS DISTRIBUTING
EVERYWHERE.

1218

01:15:58,060 --> 01:16:00,340

SO THAT CAN AFFECT THE ROOTS.

1219

01:16:00,340 --> 01:16:05,320

SO SCIENTISTS LOOK AT ALL THAT
IN CHOOSING THE KIND OF CROPS TO

1220

01:16:05,320 --> 01:16:10,590

GROW AND THEN OF COURSE THE
NUTRITIONAL LEAD WHICH CAUSED US

1221

01:16:10,590 --> 01:16:14,960

TO SETTLE DOWN ON LOOKING AT
SOME OF THE GREENS.

1222

01:16:14,960 --> 01:16:19,400

>> ERIN SHARONI.

1223

01:16:19,400 --> 01:16:32,199

IT SEEMS LIKE A TOOL IN TERMS OF
LEARNING DISABILITIES OR EVEN

1224

01:16:32,199 --> 01:16:35,150

THINGS LIKE ATTENTION DEFICIT
DISORDER WHICH IS SO COMMON NOW?

1225

01:16:35,150 --> 01:16:37,110

SEEMS LIKE IT COULD BE FAIRLY
HELPFUL.

1226

01:16:37,110 --> 01:16:38,600

>> A GREAT QUESTION.

1227

01:16:38,600 --> 01:16:44,949

AND WE DO SPEND A TON OF TIME IN
EDUCATION.

1228

01:16:44,949 --> 01:16:48,780

AND WINDOWS 10 IN GENERAL.

1229

01:16:48,780 --> 01:16:55,510

END OF APRIL, BEGINNING OF MAY,
WE STOOD UP ON BUILD AND

1230

01:16:55,510 --> 01:17:01,429

SHOWCASED THE STAGE CASE WE WERE
RESERVE UNIVERSITY WITH THE

1231

01:17:01,429 --> 01:17:03,230

CLEVELAND CLINIC.

1232

01:17:03,230 --> 01:17:07,030

THESE WERE FOLKS THAT WERE
EXPLORING USING HOLO LENS

1233

01:17:07,030 --> 01:17:11,840

AS A MEANS TO TEACH MEDICINE IN
A BRAND NEW WAY.

1234

01:17:11,840 --> 01:17:14,949

TAKE IT AND ESSENTIALLY REDO THE
CLEVELAND CLINIC AND CASE

1235

01:17:14,949 --> 01:17:19,350

WESTERN RESERVE UNIVERSITY TO
TEACH MEDICAL AND MEDICINE IN A

1236

01:17:19,350 --> 01:17:20,449

BRAND NEW WAY.

1237

01:17:20,449 --> 01:17:24,090

IF YOU THINK ABOUT MEDICINE
TODAY AND THE WAY STUDENTS LEARN

1238

01:17:24,090 --> 01:17:30,260

MEDICINE, IT'S PRIMARILY DONE ON
CADAVERS AND ON, YOU KNOW,

1239

01:17:30,260 --> 01:17:31,800
MEDICAL ILLUSTRATIONS.

1240

01:17:31,800 --> 01:17:35,330
THIS HASN'T REALLY MADE A TON OF
PROGRESS IN TERMS OF HOW WE

1241

01:17:35,330 --> 01:17:39,739
TEACH OUR STUDENTS MEDICINE IN
OVER A CENTURY.

1242

01:17:39,739 --> 01:17:43,219
BECAUSE HONESTLY THERE HASN'T
BEEN A BETTER WAY.

1243

01:17:43,219 --> 01:17:52,599
NOW WITH SOMETHING LIKE HOLO
LENS, YOU CAN SEE THE HUMAN BODY

1244

01:17:52,599 --> 01:17:58,320
IN ITS FULL FORM AND
DEMONSTRATED THIS ON STAGE.

1245

01:17:58,320 --> 01:17:59,610
CADAVERS DON'T MOVE.

1246

01:17:59,610 --> 01:18:03,520
SO HARD TO UNDERSTAND HOW A
HUMAN BODY MOVES WHEN YOU'RE

1247

01:18:03,520 --> 01:18:04,520
ACTUALLY ALIVE.

1248

01:18:04,520 --> 01:18:10,340
SO A HOLOGRAM, YOU DON'T HAVE
THOSE TYPE OF ISSUES.

1249

01:18:10,340 --> 01:18:15,330

AT FIRST WE WERE ABLE TO INSIDE
A HUMAN SEE HOW BLOOD FLOWS AS

1250

01:18:15,330 --> 01:18:16,909

AN EXAMPLE.

1251

01:18:16,909 --> 01:18:20,540

AND FOR STUDENTS THAT HAD BEEN
IN MEDICAL SCHOOL, SEEING THAT

1252

01:18:20,540 --> 01:18:24,970

HOLOGRAPHICALLY, A LOT OF THINGS
STARTING COMPLETING UP OF SOME

1253

01:18:24,970 --> 01:18:27,639

THINGS THAT THEY COULD NOT
VISUALIZE WITH MEDICAL

1254

01:18:27,639 --> 01:18:34,139

ILLUSTRATIONS OR CADAVERS.

1255

01:18:34,139 --> 01:18:38,480

WE SHOWED THIS, AS WELL, WITH
MEDICAL STUDENTS CAN ZOOM INTO

1256

01:18:38,480 --> 01:18:39,480

THE HEART.

1257

01:18:39,480 --> 01:18:44,489

IT'S A BEAUTIFUL ORGAN, BUT NOT
MUCH BIGGER THAN A HUMAN FIST.

1258

01:18:44,489 --> 01:18:48,300

NOW, IF YOU WANT IT SEE HOW
BLOOD FLOWS INSIDE AND OUTSIDE

1259

01:18:48,300 --> 01:18:52,560

OF THE HEART, WITH THE HEART

KIND OF CUT HALFWAY THROUGH IT,

1260

01:18:52,560 --> 01:18:55,989

AT A SIZE WHERE YOU CAN ACTUALLY
UNDERSTAND AND SEE AND FEEL

1261

01:18:55,989 --> 01:19:00,010

WHERE ALL THESE LITTLE VEINS AND
BLOOD IS FLOWING IN AND OUT,

1262

01:19:00,010 --> 01:19:04,449

HOLOGRAMS GIVE YOU THAT ABILITY
IN A VERY EASY FORM.

1263

01:19:04,449 --> 01:19:13,590

SO WITH THINGS LIKE THIS, WE'RE
ALSO DOING RESEARCH IN THAT

1264

01:19:13,590 --> 01:19:14,590

AREA.

1265

01:19:14,590 --> 01:19:19,830

>> IF I COULD ADD IN THE CONTEXT
OF NASA, IT'S OPERATIONALLY

1266

01:19:19,830 --> 01:19:25,199

SIGNIFICANT THAT WE CAN PUT EYES
ON THE TASK THAT THEY'RE

1267

01:19:25,199 --> 01:19:26,199

PERFORMING.

1268

01:19:26,199 --> 01:19:28,560

BUT I THINK IT'S ALSO
POTENTIALLY EXCITING SPEAKING

1269

01:19:28,560 --> 01:19:32,260

PERSONALLY EVEN TO SEE THAT
PERSPECTIVE FOR MYSELF ABOUT

1270

01:19:32,260 --> 01:19:36,080

WHAT IS THE PERSPECTIVE OF AN
ASTRONAUT AS THEY'RE WORKING ON

1271

01:19:36,080 --> 01:19:39,050

THE MANY TASKS THAT THEY HAVE TO
COMPLETE ONBOARD THE STATION.

1272

01:19:39,050 --> 01:19:42,220

IT'S NOT A PERSPECTIVE THAT HAS
BEEN EASY FOR US TO GET UNTIL

1273

01:19:42,220 --> 01:19:43,220

NOW.

1274

01:19:43,220 --> 01:19:44,510

SO I THINK THAT THERE ARE
EDUCATIONAL IMPLICATIONS OF

1275

01:19:44,510 --> 01:19:47,079

THAT, AS WELL.

1276

01:19:47,079 --> 01:19:49,010

>> LEWIS SHEPARD, WASHINGTON,
D.C.

1277

01:19:49,010 --> 01:19:50,699

NASA SOCIAL.

1278

01:19:50,699 --> 01:19:53,699

TWITTER LEWIS SHEPARD.

1279

01:19:53,699 --> 01:20:00,110

SO FOR MY COLLEAGUE, I WORKED
WITH ALEX AND HIS TEAM LAST YEAR

1280

01:20:00,110 --> 01:20:01,110

ON THIS.

1281

01:20:01,110 --> 01:20:02,929

A QUESTION FOR JEFF AND DR.

1282

01:20:02,929 --> 01:20:03,929

ROBINSON.

1283

01:20:03,929 --> 01:20:04,929

NONSPACE.

1284

01:20:04,929 --> 01:20:10,780

SO WHAT USES HAVE YOU EXPLORED
OR DO YOU ANTICIPATE EXPLORING

1285

01:20:10,780 --> 01:20:16,570

IN INDUSTRIAL DESIGN AND THE 3D
HOLOGRAPHIC DESIGN USE OF THE

1286

01:20:16,570 --> 01:20:24,050

HOLO STUDIO FOR MANIPULATION AND
INDUSTRIAL DESIGN?

1287

01:20:24,050 --> 01:20:33,320

>> AS I MENTIONED EARLIER, I
THINK WITH THESE TECHNOLOGIES, I

1288

01:20:33,320 --> 01:20:36,080

BELIEVE WE'RE VERY EARLY RIGHT
NOW WHICH IS VERY EXCITING.

1289

01:20:36,080 --> 01:20:38,790

BECAUSE I THINK THAT THERE ARE
SO MANY THINGS THAT WE HAVE YET

1290

01:20:38,790 --> 01:20:40,920

TO EXPLORE ABOUT HOW WE CAN USE
THESE TECHNOLOGIES.

1291

01:20:40,920 --> 01:20:44,750

THERE ARE A LOT OF IDEAS WE'RE

WORKING ON.

1292

01:20:44,750 --> 01:20:48,151

ONE THAT COMES TO MIND I CAN
BRING UP TODAY IS THAT IF YOU

1293

01:20:48,151 --> 01:20:51,290

THINK ABOUT SOME OF THE TASKS
THAT WE'RE GOING TO USE SIDEKICK

1294

01:20:51,290 --> 01:20:57,239

FOR TO ASSIST CREW AT THE JET
PROPULSION LABORATORY WHERE I

1295

01:20:57,239 --> 01:21:00,679

WORK, A SIMPLE SPACECRAFT IN A
CLEAN ROOM AND IN THAT CLEAN

1296

01:21:00,679 --> 01:21:05,510

ROOM ENVIRONMENT, IT'S OFTEN
EITHER NOT CONVENIENT OR CAN BE

1297

01:21:05,510 --> 01:21:09,060

EXPENSIVE OR TIME CONSUMING FOR
PEOPLE TO GO INTO THAT

1298

01:21:09,060 --> 01:21:11,690

ENVIRONMENT BECAUSE THEY HAVE TO
BE SUITED UP, THEY HAVE TO GO

1299

01:21:11,690 --> 01:21:14,710

THROUGH AN AIR LOCK AND NUMBER
OF OTHER PROCEDURES BEFORE THEY

1300

01:21:14,710 --> 01:21:18,510

CAN BE CLOSE TO ONE OF OUR
SENSITIVE PIECES OF SPACECRAFT

1301

01:21:18,510 --> 01:21:19,570

HARDWARE.

1302

01:21:19,570 --> 01:21:23,239

SO BEING ABLE TO PROJECT
EXPERTISE FROM SOMEONE WHO IS

1303

01:21:23,239 --> 01:21:26,710

NOT IN THAT ENVIRONMENT FROM A
DISTANT LOCATION INTO THAT

1304

01:21:26,710 --> 01:21:31,230

ENVIRONMENT IS ACTUALLY QUITE A
COMPELLING POTENTIAL USE CASE

1305

01:21:31,230 --> 01:21:33,950

FOR US THAT IS SIMILAR TO WHAT
WE'RE TRYING TO DO ON BOARD OF

1306

01:21:33,950 --> 01:21:36,610

STATION AND YET ALSO A BIT
DISTINCT.

1307

01:21:36,610 --> 01:21:38,760

SO I THINK THAT IS AN EXAMPLE
AND I THINK THERE WILL BE MANY

1308

01:21:38,760 --> 01:21:40,000

MORE.

1309

01:21:40,000 --> 01:21:42,409

>> TIME FOR ONE MORE QUESTIONS.

1310

01:21:42,409 --> 01:21:45,360

>> I'M WITH NASA SOCIAL.

1311

01:21:45,360 --> 01:21:48,480

I WAS JUST WONDERING WHAT IT'S
GOING TO BE LIKE IF YOU NEED TO

1312

01:21:48,480 --> 01:21:52,110

HAVE ANY SOFTWARE UPDATES FOR
HOLO LENS AND IF THAT WILL BE

1313

01:21:52,110 --> 01:21:55,890

ABLE TO BE TRANSMITTED UP TO THE
SPACE STATION AND DO YOU THINK

1314

01:21:55,890 --> 01:22:03,030

THERE WILL BE ANY COMPETITION
WITH GOOGLE GLASS.

1315

01:22:03,030 --> 01:22:06,969

>> WITH THE TWO THAT WE'RE
LAUNCHING UP WITH PROJECT

1316

01:22:06,969 --> 01:22:13,590

SIDEKICK, WE'VE LAUNCHED UP A
LAPTOP†-- OR WE WILL BE THAT

1317

01:22:13,590 --> 01:22:16,370

WILL BE CONFIGURED TO AMONG
OTHER THINGS ALLOW US TO PERFORM

1318

01:22:16,370 --> 01:22:20,530

SOFTWARE UPDATES AND ANY KIND OF
DIAGNOSIS OR COLLECTION OF

1319

01:22:20,530 --> 01:22:24,980

TELEMETRY THAT WE NEED IN ORDER
TO EVALUATE THE EXPERIMENT.

1320

01:22:24,980 --> 01:22:35,610

SO, YES, OUR PLAN IS TO UPDATE
THE DEVICE.

1321

01:22:35,610 --> 01:22:40,310

WITH REGARDS TO YOUR QUESTION ON
GOOGLE GLASS, THESE TECHNOLOGIES

1322

01:22:40,310 --> 01:22:43,780

AS I'VE MENTIONED EARLIER ARE
SOMETHING THAT THE AGENCY NASA

1323

01:22:43,780 --> 01:22:46,830

IS EXPLORING IN A LOT OF
DIFFERENT APPLICATIONS.

1324

01:22:46,830 --> 01:22:53,090

AND THESE EARLY EXPERIMENTS ARE
GOING TO TEACH US ABOUT HOW EACH

1325

01:22:53,090 --> 01:22:57,040

OF THESE TECHNOLOGIES IS BEST
SUITED FOR PARTICULAR CHALLENGES

1326

01:22:57,040 --> 01:22:59,400

THAT WE HAVE WITHIN NASA.

1327

01:22:59,400 --> 01:23:02,260

AND IT MAY TURN OUT THAT CERTAIN
DEVICES ARE WELL SUITED FOR

1328

01:23:02,260 --> 01:23:05,130

CERTAIN CHALLENGES AND OTHERS
FOR OTHER CHALLENGES.

1329

01:23:05,130 --> 01:23:09,340

SO IT'S QUITE POSSIBLE THAT
WE'LL SEE MORE EXAMPLES OF THESE

1330

01:23:09,340 --> 01:23:13,329

KINDS OF TECHNOLOGIES ON BOARD
THE SPACE STATION AND IN OTHER

1331

01:23:13,329 --> 01:23:18,030

ENVIRONMENTS THAT NASA IS
PERFORMING PROJECTS.

1332

01:23:18,030 --> 01:23:20,040

>> SCIENCE FICTION TURNING IN TO

SCIENCE FACT.

1333

01:23:20,040 --> 01:23:22,949

I KNOW THERE ARE SOME HANDS UP.

1334

01:23:22,949 --> 01:23:25,750

I BELIEVE JEFF AND JULIE WILL BE
AROUND AFTERWARDS.

1335

01:23:25,750 --> 01:23:32,000

LET'S GIVE A ROUND OF APPLAUSE
TO ALL OF OUR PRESENTERS.

1336

01:23:32,000 --> 01:23:38,070

[†APPLAUSE†]

SO SUNDAY AT 10:21 EASTERN TIME,

1337

01:23:38,070 --> 01:23:42,670

SpaceX LAUNCHING THE RESUPPLY
MISSION, A LOT OF THE SCIENCE

1338

01:23:42,670 --> 01:23:44,440

THAT WAS DISCUSSED HERE TODAY.

1339

01:23:44,440 --> 01:23:46,110

YOU CAN WATCH ON NASA TELEVISION
WWW.NASA.GOV/NASA_TV.