

STEMonstrations



SPACEWALK PART 2: SPACESUITS



1
00:00:01,067 --> 00:00:15,415
[MUSIC]

2
00:00:15,415 --> 00:00:16,783
>> SO WE ARE STANDING IN

3
00:00:16,783 --> 00:00:18,385
THE QUEST AIRLOCK, WHICH IS

4
00:00:18,385 --> 00:00:19,986
DIVIDED INTO TWO PARTS.

5
00:00:19,986 --> 00:00:21,855
WE HAVE THE EQUIPMENT LOCK

6
00:00:21,855 --> 00:00:23,323
AND WE HAVE THE CREW LOCK.

7
00:00:23,323 --> 00:00:24,290
THIS EQUIPMENT LOCK HAS

8
00:00:24,290 --> 00:00:26,092
A HATCH RIGHT HERE THAT CLOSES,

9
00:00:26,092 --> 00:00:27,260
AND THE CREW LOCK HAS

10
00:00:27,260 --> 00:00:28,728
ANOTHER HATCH.

11
00:00:28,728 --> 00:00:30,797
THE EMU, OR THE EXTRAVEHICULAR

12
00:00:30,797 --> 00:00:33,533
MOBILITY UNIT, IS OUR SPACESUIT.

13
00:00:33,533 --> 00:00:34,601

AND IT'S DIVIDED ROUGHLY

14

00:00:34,601 --> 00:00:35,535
INTO TWO PARTS.

15

00:00:35,535 --> 00:00:37,237
WE HAVE THE HARD UPPER TORSO

16

00:00:37,237 --> 00:00:38,271
WHICH IS ALMOST LIKE

17

00:00:38,271 --> 00:00:39,839
A TURTLE SHELL-- UM,

18

00:00:39,839 --> 00:00:41,941
IT'S A HARD FIBERGLASS SHELL.

19

00:00:41,941 --> 00:00:42,842
AND THEN WE ALSO HAVE

20

00:00:42,842 --> 00:00:44,310
THE LOWER TORSO ASSEMBLY.

21

00:00:44,310 --> 00:00:45,678
THESE SPACESUITS ARE

22

00:00:45,678 --> 00:00:47,480
OUR OWN LITTLE SPACECRAFT,

23

00:00:47,480 --> 00:00:48,415
AND THEY HAVE

24

00:00:48,415 --> 00:00:49,616
EVERYTHING YOU NEED

25

00:00:49,616 --> 00:00:51,484
TO KEEP YOU ALIVE OUT IN SPACE

26
00:00:51,484 --> 00:00:53,253
FOR SEVEN TO EIGHT HOURS,

27
00:00:53,253 --> 00:00:54,754
UM, MAYBE EVEN LONGER,

28
00:00:54,754 --> 00:00:55,688
UH, DEPENDING ON

29
00:00:55,688 --> 00:00:56,790
HOW HARD YOU'RE WORKING.

30
00:00:56,790 --> 00:00:57,891
THE ONLY THING THAT

31
00:00:57,891 --> 00:00:59,125
THEY DO NOT HAVE-- AND THEY HAVE

32
00:00:59,125 --> 00:01:00,660
RADIOS, IT HAS OXYGEN,

33
00:01:00,660 --> 00:01:02,495
IT HAS CARBON DIOXIDE SCRUBBING,

34
00:01:02,495 --> 00:01:04,364
IT HAS TEMPERATURE CONTROL--

35
00:01:04,364 --> 00:01:05,832
IT HAS EVERYTHING YOU NEED

36
00:01:05,832 --> 00:01:07,434
EXCEPT FOR ONE THING:

37
00:01:07,434 --> 00:01:09,936
A RESTROOM.

38
00:01:09,936 --> 00:01:11,037

AND SO WHEN WE GET READY FOR

39

00:01:11,037 --> 00:01:12,138

OUR EVA, THE FIRST THING

40

00:01:12,138 --> 00:01:13,306

WE PUT ON THE MORNING--

41

00:01:13,306 --> 00:01:15,909

IN THE MORNING IS A-A DIAPER.

42

00:01:15,909 --> 00:01:18,244

AND, UM, THAT'S OUR FIRST LAYER.

43

00:01:18,244 --> 00:01:20,113

THEN OVER THE DIAPER, WE PUT ON

44

00:01:20,113 --> 00:01:21,414

A PAIR OF LONG JOHNS,

45

00:01:21,414 --> 00:01:22,315

AND THAT'S TO KEEP

46

00:01:22,315 --> 00:01:23,316

OUR ARMS AND LEGS FROM GETTING

47

00:01:23,316 --> 00:01:24,017

SCRAPED UP.

48

00:01:24,017 --> 00:01:25,051

IT ALSO PROVIDES

49

00:01:25,051 --> 00:01:25,919

A LITTLE BIT OF WICKING

50

00:01:25,919 --> 00:01:26,786

IN CASE YOU'RE GETTING

51
00:01:26,786 --> 00:01:28,188
REALLY HOT AND SWEATY.

52
00:01:28,188 --> 00:01:29,823
THE NEXT LAYER IS

53
00:01:29,823 --> 00:01:32,358
OUR LIQUID COOLING GARMENT.

54
00:01:32,358 --> 00:01:34,394
AND THE LCVG HAS LITTLE TUBES

55
00:01:34,394 --> 00:01:35,762
RUNNING THROUGH IT

56
00:01:35,762 --> 00:01:37,497
WHICH ALLOW WATER TO CIRCULATE

57
00:01:37,497 --> 00:01:40,233
WITHINSIDE THE LCVG TO, UH,

58
00:01:40,233 --> 00:01:41,301
TO PROVIDE COOLING

59
00:01:41,301 --> 00:01:42,202
WHEN WE'RE OUTSIDE

60
00:01:42,202 --> 00:01:43,736
WORKIN' REALLY HARD.

61
00:01:43,736 --> 00:01:45,205
SO WE'VE GOT THE DIAPER,

62
00:01:45,205 --> 00:01:46,673
WE'VE GOT LONG JOHNS, WE'VE GOT

63
00:01:46,673 --> 00:01:48,308

THE LCVG, AND THEN

64
00:01:48,308 --> 00:01:50,109
WE'RE GONNA WEAR OUR SPACESUIT.

65
00:01:50,109 --> 00:01:51,444
SEVEN LAYERS FROM THE BLADDER

66
00:01:51,444 --> 00:01:52,512
ON THE INSIDE WHICH

67
00:01:52,512 --> 00:01:54,047
MAINTAINS-MAINTAINS PRESSURE,

68
00:01:54,047 --> 00:01:55,482
AND THAT'S A RUBBERIZED BLADDER,

69
00:01:55,482 --> 00:01:56,483
ALL THE WAY OUT TO THE WHITE

70
00:01:56,483 --> 00:01:58,017
LAYER ON THE OUTSIDE.

71
00:01:58,017 --> 00:02:00,353
THE CREW MEMBER INSIDE OF

72
00:02:00,353 --> 00:02:01,688
THIS SPACESUIT IS ALSO WEARING

73
00:02:01,688 --> 00:02:02,622
THIS-- WHAT WE CALL

74
00:02:02,622 --> 00:02:04,224
A SNOOPY CAP.

75
00:02:04,224 --> 00:02:05,825
UM, IT'S A COMMUNICATIONS CAP.

76

00:02:05,825 --> 00:02:06,826

WE HAVE A RADIO SO WE CAN

77

00:02:06,826 --> 00:02:08,094

TALK TO NOT ONLY HOUSTON,

78

00:02:08,094 --> 00:02:09,062

BUT WE CAN TALK TO

79

00:02:09,062 --> 00:02:10,096

PEOPLE ON THE SPACE STATION

80

00:02:10,096 --> 00:02:11,731

AND TO EACH OTHER.

81

00:02:11,731 --> 00:02:12,599

SO WE WEAR THIS

82

00:02:12,599 --> 00:02:13,666

COMMUNICATION CAP INSIDE

83

00:02:13,666 --> 00:02:15,668

THE-- INSIDE THE HELMET.

84

00:02:16,870 --> 00:02:18,338

ALSO A PAR-- ANOTHER COMPO--

85

00:02:18,338 --> 00:02:20,206

KEY COMPONENT OF THE, UH,

86

00:02:20,206 --> 00:02:22,075

OF THE EMU OR OUR SPACESUIT

87

00:02:22,075 --> 00:02:23,343

IS THE HELMET.

88

00:02:23,343 --> 00:02:24,577

UH, YOU CAN SEE THE HELMET HAS

89

00:02:24,577 --> 00:02:26,679

A GOLD VISOR, UH, WHICH

90

00:02:26,679 --> 00:02:28,014

PRO-PROTECTS US FROM

91

00:02:28,014 --> 00:02:29,516

THE-THE RAYS OF THE SUN

92

00:02:29,516 --> 00:02:31,351

THAT WE CAN BRING DOWN.

93

00:02:31,351 --> 00:02:32,252

UH, IT'S PRETTY BRIGHT

94

00:02:32,252 --> 00:02:33,653

OUT THERE, AND THIS GOLD VISOR,

95

00:02:33,653 --> 00:02:34,821

UH, HELPS REFLECT

96

00:02:34,821 --> 00:02:35,822

THE RAYS OF THE SUN

97

00:02:35,822 --> 00:02:36,890

SO THAT WE CAN ACTUALLY SEE

98

00:02:36,890 --> 00:02:39,092

AND OPERATE, UH, IN-IN DAYLIGHT.

99

00:02:39,092 --> 00:02:40,493

AT NIGHTTIME, WE CAN

100

00:02:40,493 --> 00:02:42,161

RAISE THIS VISOR UP.

101
00:02:42,161 --> 00:02:43,863
IT GIVES US A CLEARER VIEW.

102
00:02:43,863 --> 00:02:44,764
AND ADDITIONALLY, WE HAVE

103
00:02:44,764 --> 00:02:45,899
HELMET LIGHTS BUILT INTO

104
00:02:45,899 --> 00:02:47,166
THE HELMET.

105
00:02:47,166 --> 00:02:48,234
ON TOP OF THE HELMET,

106
00:02:48,234 --> 00:02:50,069
WE ALSO HAVE A TELEVISION CAMERA

107
00:02:50,069 --> 00:02:51,704
SO THAT GROUND IS ABLE TO

108
00:02:51,704 --> 00:02:52,906
WATCH US WHILE WE WORK

109
00:02:52,906 --> 00:02:54,941
THROUGH THESE TV CAMERAS.

110
00:02:54,941 --> 00:02:56,342
THE WORK IS REALLY ALL DONE

111
00:02:56,342 --> 00:02:57,610
WITH HANDS.

112
00:02:57,610 --> 00:02:59,279
AND, UM, SO OUR GLOVES ARE

113
00:02:59,279 --> 00:03:00,413

REALLY OUR MOST IMPORTANT

114

00:03:00,413 --> 00:03:01,548

PIECE OF EQUIPMENT

115

00:03:01,548 --> 00:03:03,149

IN ORDER FOR US TO WORK OUTSIDE.

116

00:03:03,149 --> 00:03:04,817

AND ONE OF THE REAL CHALLENGES

117

00:03:04,817 --> 00:03:06,252

OF A SPACEWALK IS YOU HAVE

118

00:03:06,252 --> 00:03:07,420

THIS HEAVY GLOVED HAND

119

00:03:07,420 --> 00:03:08,755

WHICH IS INFLATED,

120

00:03:08,755 --> 00:03:10,323

SO IT WANTS TO STAY LIKE

121

00:03:10,323 --> 00:03:11,891

IT'S BLOWN UP LIKE A BALLOON.

122

00:03:11,891 --> 00:03:14,727

BUT WE WALK BY GRABBING ONTO

123

00:03:14,727 --> 00:03:16,229

HANDRAILS AND MAKING OUR WAY

124

00:03:16,229 --> 00:03:17,730

ALONG THE ISS.

125

00:03:17,730 --> 00:03:19,265

SO EVERY TIME YOU MOVE

126
00:03:19,265 --> 00:03:20,867
YOUR HAND, YOU'RE FIGHTING

127
00:03:20,867 --> 00:03:22,101
AGAINST A BALLOON THAT

128
00:03:22,101 --> 00:03:23,469
WANTS TO INFLATE.

129
00:03:23,469 --> 00:03:24,571
AND THEN ON TOP OF THAT,

130
00:03:24,571 --> 00:03:25,672
ALL OF OUR EQUIPMENT IS

131
00:03:25,672 --> 00:03:27,040
BASED ON USING YOUR HANDS, TOO.

132
00:03:27,040 --> 00:03:28,074
SO AFTER SIX AND A HALF,

133
00:03:28,074 --> 00:03:29,108
SEVEN HOURS OF KIND OF

134
00:03:29,108 --> 00:03:30,743
FIGHTING AGAINST THIS GLOVE,

135
00:03:30,743 --> 00:03:31,978
IT'S A REALLY LONG DAY,

136
00:03:31,978 --> 00:03:32,979
AND YOUR HANDS ARE PROBABLY

137
00:03:32,979 --> 00:03:33,947
THE THING THAT ARE

138
00:03:33,947 --> 00:03:35,582

MOST EXHAUSTED AFTER-AFTER

139

00:03:35,582 --> 00:03:38,151

SEVEN HOURS OUT ON AN EVA.

140

00:03:38,151 --> 00:03:39,285

WELL, WE'RE GOIN' OUT TO WORK.

141

00:03:39,285 --> 00:03:40,820

YOU PROBABLY SAW ME MOVE, UH,

142

00:03:40,820 --> 00:03:42,255

THIS MINI WORKSTATION.

143

00:03:42,255 --> 00:03:43,890

THE WAY WE CARRY OUR TOOLS

144

00:03:43,890 --> 00:03:45,091

IS ON A MINI WORKSTATION,

145

00:03:45,091 --> 00:03:46,025

WHICH IS CARRIED

146

00:03:46,025 --> 00:03:46,960

ON THE FRONT.

147

00:03:46,960 --> 00:03:48,227

EVERY SINGLE TOOL WE USE

148

00:03:48,227 --> 00:03:50,129

IS TETHERED TO US.

149

00:03:50,129 --> 00:03:51,364

WE DO NOT WANNA ACCIDENTALLY

150

00:03:51,364 --> 00:03:53,032

CREATE SATELLITES.

151
00:03:53,032 --> 00:03:54,701
OUR PRIMARY WAY OF

152
00:03:54,701 --> 00:03:56,869
REMAINING ATTACHED TO THE ISS,

153
00:03:56,869 --> 00:03:58,004
IF WE'RE NOT USING OUR HANDS,

154
00:03:58,004 --> 00:03:59,606
ARE THESE WEIGHT TETHERS.

155
00:03:59,606 --> 00:04:00,406
AND YOU CAN SEE,

156
00:04:00,406 --> 00:04:01,407
THEY JUST HAVE A BIG HOOK,

157
00:04:01,407 --> 00:04:02,442
THEY GO AROUND A RAIL

158
00:04:02,442 --> 00:04:03,676
OR, UH, TH-- ANYTHING ELSE

159
00:04:03,676 --> 00:04:05,712
ON THE ISS, AND LATCH ON,

160
00:04:05,712 --> 00:04:06,646
AND IT ACTUALLY HAS

161
00:04:06,646 --> 00:04:07,914
A LOCKING MECHANISM AS WELL

162
00:04:07,914 --> 00:04:09,349
TO HOLD US NICE AND TIGHT.

163
00:04:09,349 --> 00:04:10,583

SO WE ALWAYS-ALWAYS WANNA HAVE

164

00:04:10,583 --> 00:04:11,517

ONE OF THESE ATTACHED

165

00:04:11,517 --> 00:04:12,418

IF WE'RE NOT HOLDING ON

166

00:04:12,418 --> 00:04:13,820

WITH OUR HANDS AS WELL.

167

00:04:13,820 --> 00:04:15,254

THE BACK OF THE EMU HAS

168

00:04:15,254 --> 00:04:17,156

OUR LIFE SUPPORT SYSTEM.

169

00:04:17,156 --> 00:04:18,825

THE LIFE SUPPORT SYSTEM, UH,

170

00:04:18,825 --> 00:04:20,059

CONTAINS ALL THE EQUIPMENT

171

00:04:20,059 --> 00:04:21,661

WE NEED, FROM A-- FROM

172

00:04:21,661 --> 00:04:23,229

A UHF RADIO DOWN TO

173

00:04:23,229 --> 00:04:24,631

THE OXYGEN TANKS THAT PROVIDE

174

00:04:24,631 --> 00:04:25,965

PRIMARY OXYGEN.

175

00:04:25,965 --> 00:04:27,033

AND ONE OF THE CHALLENGES

176
00:04:27,033 --> 00:04:28,668
INSIDE THIS SEALED ENVIRONMENT--

177
00:04:28,668 --> 00:04:29,769
IT'S VERY EASY TO CARRY

178
00:04:29,769 --> 00:04:30,903
OUR OWN OXYGEN WITH US,

179
00:04:30,903 --> 00:04:31,804
BUT WE GENERATE A LOT OF

180
00:04:31,804 --> 00:04:32,872
CARBON DIOXIDE, PARTICULARLY

181
00:04:32,872 --> 00:04:33,906
WHEN WE'RE OUT THERE WORKING

182
00:04:33,906 --> 00:04:35,074
VERY HARD.

183
00:04:35,074 --> 00:04:36,676
SO TO COMBAT THAT, TO DEAL WITH

184
00:04:36,676 --> 00:04:37,844
THAT, WE HAVE THESE CANISTERS

185
00:04:37,844 --> 00:04:40,146
CALLED, UH, MED OX CANISTERS,

186
00:04:40,146 --> 00:04:41,581
WHICH ARE JUST SILVER OXIDE.

187
00:04:41,581 --> 00:04:43,516
THEY'RE CARRIED IN THE BACKPACK,

188
00:04:43,516 --> 00:04:44,917

UH, ALONG WITH A VERY LARGE

189

00:04:44,917 --> 00:04:46,019

BATTERY WHICH PROVIDES

190

00:04:46,019 --> 00:04:47,687

ALL THE ELECTRICITY FOR US.

191

00:04:47,687 --> 00:04:48,855

I DON'T HAVE A BATTERY HERE

192

00:04:48,855 --> 00:04:49,856

TO SHOW YOU TODAY BECAUSE

193

00:04:49,856 --> 00:04:50,757

WE'RE IN THE PROCESS

194

00:04:50,757 --> 00:04:51,658

OF CHARGING 'EM.

195

00:04:51,658 --> 00:04:52,625

WE'RE ABOUT A MONTH OUT

196

00:04:52,625 --> 00:04:53,559

FROM DOIN' A SPACEWALK,

197

00:04:53,559 --> 00:04:54,427

AND WE'VE ALREADY STARTED

198

00:04:54,427 --> 00:04:56,029

GETTING READY FOR THAT.

199

00:04:56,029 --> 00:04:57,363

SO THIS MED OX CANISTER IS

200

00:04:57,363 --> 00:04:58,564

ABOUT ABLE TO-- IS ABLE TO

201
00:04:58,564 --> 00:04:59,799
REMOVE ABOUT, UH,

202
00:04:59,799 --> 00:05:00,767
SEVEN TO EIGHT HOURS

203
00:05:00,767 --> 00:05:01,668
OF CARBON DIOXIDE THAT

204
00:05:01,668 --> 00:05:02,669
A HUMAN CAN GENERATE

205
00:05:02,669 --> 00:05:04,170
INSIDE THE SPACESUIT.

206
00:05:05,705 --> 00:05:06,939
EVAs HAVE ALLOWED US TO BUILD

207
00:05:06,939 --> 00:05:08,541
AND MAINTAIN THE ISS, REPAIR

208
00:05:08,541 --> 00:05:10,109
MISSION-CRITICAL HARDWARE,

209
00:05:10,109 --> 00:05:11,778
INVESTIGATE MALFUNCTIONS,

210
00:05:11,778 --> 00:05:13,579
INSTALL NEW HARDWARE--

211
00:05:13,579 --> 00:05:15,782
AND THE VIEW, UNBELIEVABLE.