
Marty
Kelsey
Beth
Wilson

1
00:00:13,280 --> 00:00:14,370
>>> WOW.

2
00:00:14,370 --> 00:00:19,820
I THINK WE GOT SOMETHING.

3
00:00:19,820 --> 00:00:22,480
I BETTER TALK TO MARK.

4
00:00:22,480 --> 00:00:24,520
HEY, MARK.

5
00:00:24,520 --> 00:00:26,560
>> HEY DAVID.

6
00:00:26,560 --> 00:00:27,910
>> WE HAVE A NEW ASTEROID.

7
00:00:27,910 --> 00:00:29,369
>> A NEW ASTEROID
>> YEP.

8
00:00:29,369 --> 00:00:31,980
>> I BETTER GET THE 730 TEAM
TOGETHER.

9
00:00:31,980 --> 00:00:34,960
YOU KNOW THEY SCATTER AFTER THE
SHOW SO LET ME SEE IF I CAN GET

10
00:00:34,960 --> 00:00:40,120
THEM.

11
00:00:40,120 --> 00:00:50,440
>>> HI, MARK.

12
00:00:50,440 --> 00:00:56,480
THE WHOLE TEAM IS HERE.

13
00:00:56,480 --> 00:00:59,059
>> DAVID SAID A NEW ASTEROID HAS
JUST BEEN DISCOVERED.

14
00:00:59,059 --> 00:01:02,129
>> WHEN WILL IT HIT THE EARTH?

15
00:01:02,129 --> 00:01:03,700
>> IT DOESN'T HIT THE EARTH.

16
00:01:03,700 --> 00:01:06,470
I THINK WE NEED TO TEACH
STUDENTS ABOUT ASTEROIDS AND

17
00:01:06,470 --> 00:01:08,299
NASA'S REDIRECT MISSION.

18
00:01:08,299 --> 00:01:09,700
>> HOW MUCH TIME DO WE HAVE?

19
00:01:09,700 --> 00:01:10,890
>> 30 MINUTES.

20
00:01:10,890 --> 00:01:12,100
>> WHEN DO WE START?

21
00:01:12,100 --> 00:01:23,070
>> RIGHT NOW BECAUSE THIS IS
730.

22
00:01:23,070 --> 00:02:00,229
\M\M
>>> THIS IS 730.

23
00:02:00,229 --> 00:02:01,259
>> HI I'M MARTY.

24

00:02:01,259 --> 00:02:02,259
>> I'M BETH.

25
00:02:02,259 --> 00:02:05,660
>> WE'RE COMING LIVE TO YOU FROM
THE AIR AND SPACE MUSEUM IN

26
00:02:05,660 --> 00:02:10,380
WASHINGTON, D.C.

27
00:02:10,380 --> 00:02:14,760
OOH THIS GALLERY IS PHENOMENAL.

28
00:02:14,760 --> 00:02:17,010
ONE OF MY FAVORITE IN THE ENTIRE
MUSEUM.

29
00:02:17,010 --> 00:02:20,620
SOME ARTIFACTS IN HERE BILL PLOW
AWAY.

30
00:02:20,620 --> 00:02:25,659
>> YOU'VE CONVINCED ME.

31
00:02:25,659 --> 00:02:28,170
>> THIS GALLERY IS DEDICATED TO
THE SPACE SHUTTLE AND SPACE

32
00:02:28,170 --> 00:02:32,099
SHUTTLE ERA.

33
00:02:32,099 --> 00:02:38,360
ON HERE ARE SPACE SUITS WORE BY
SALLY RIDE AND THE FIRST

34
00:02:38,360 --> 00:02:40,560
AFRICAN-AMERICAN ASTRONAUT.

35
00:02:40,560 --> 00:02:45,209

>> YOU CAN VISIT THE MID-DECK TO
EXPLORE A LOT OF ARTIFACTS.

36
00:02:45,209 --> 00:02:48,840
A CAN OF SODA, BUZZ LIGHT YEAR
AND OTHER ITEMS.

37
00:02:48,840 --> 00:02:53,459
>> WHEN YOU COME TO THIS GALLERY
YOU CAN'T HELP NOTICE THE

38
00:02:53,459 --> 00:02:55,209
AMAZING MODELS.

39
00:02:55,209 --> 00:02:57,650
HANGING FROM THE CEILING IS A
SCALE MODEL OF THE INTERNATIONAL

40
00:02:57,650 --> 00:03:01,000
SPACE STATION AND ACROSS THE
ROOM IS A SPACE MODEL OF THE

41
00:03:01,000 --> 00:03:04,760
SPACE STATION COLUMBIA.

42
00:03:04,760 --> 00:03:08,629
>> LET'S WELCOME OUR INHOUSE
AUDIENCE, WHITTAKER EDUCATION

43
00:03:08,629 --> 00:03:09,629
CAMPUS.

44
00:03:09,629 --> 00:03:12,960
THANK YOU ALL FOR BEING HERE
TODAY.

45
00:03:12,960 --> 00:03:15,209
>> WE ALSO WANT TO THANK OUR
ONLINE VIEWERS AND THOSE

46
00:03:15,209 --> 00:03:17,030
WATCHING ON NASA TV.

47
00:03:17,030 --> 00:03:20,751
IF YOU GO TO WEBSITE SUBMIT
QUESTIONS THAT WE'LL HAVE A

48
00:03:20,751 --> 00:03:24,340
DOCENT READY TO ANSWER.

49
00:03:24,340 --> 00:03:28,950
>> SO, MARTY, WHY DO WE WANT TO
STUDY ASTEROIDS?

50
00:03:28,950 --> 00:03:30,549
>> THAT'S A GREAT QUESTION.

51
00:03:30,549 --> 00:03:34,000
TO HELP US ANSWER THAT QUESTION
WE HAVE THE PROGRAM MANAGER FROM

52
00:03:34,000 --> 00:03:36,580
NASA'S ASTEROID REDIRECT
MISSION.

53
00:03:36,580 --> 00:03:43,040
I WANT TO GET YOU GUYS INVOLVED
REAL QUICK.

54
00:03:43,040 --> 00:03:46,159
THESE GUYS IN THE AUDIENCE HAVE
GO AND NO GO SIGNS.

55
00:03:46,159 --> 00:03:49,599
WE'RE GOING TO TALK ABOUT A
COUPLE OF DIFFERENT CONCEPTS

56
00:03:49,599 --> 00:03:52,769
THAT WE HAD FOR THE MISSION AT

THE OUTSET.

57
00:03:52,769 --> 00:03:55,500
WE'RE GOING TO ASK YOU TO GIVE
US A GO OR NO GO FOR THAT

58
00:03:55,500 --> 00:03:59,010
CONCEPT AND WE'LL SEE WHICH ONE
THEY CHOOSE.

59
00:03:59,010 --> 00:04:03,959
ONE IDEA IS TO GO OUT IN SPACE,
FIND A SMALL ASTEROID AND GRAB

60
00:04:03,959 --> 00:04:06,290
IT AND BRING IT BACK TOWARDS
EARTH.

61
00:04:06,290 --> 00:04:11,019
THE OTHER IDEA IS TO GO OUT,
LAND ON AN ASTEROID, PICK UP A

62
00:04:11,019 --> 00:04:14,000
BOWLED FRIRT, BRING THAT BOULDER
BACK TOWARDS EARTH.

63
00:04:14,000 --> 00:04:15,420
BOTH OF THESE ARE VERY COMPLEX.

64
00:04:15,420 --> 00:04:19,049
YOU HAVE TO THINK ABOUT THE COST
AND SAFETY AND THE DESIGN

65
00:04:19,049 --> 00:04:20,049
CHALLENGES.

66
00:04:20,049 --> 00:04:22,630
SO LET'S SEE WHAT YOU GUYS THINK
FOR GO OR NO GO.

67
00:04:22,630 --> 00:04:25,470
HOW ABOUT THE FIRST ONE, GOING
OUT AND GRABBING A SMALLER

68
00:04:25,470 --> 00:04:27,850
ASTEROID, GRABBING IT AND
BRINGING IT BACK TO EARTH.

69
00:04:27,850 --> 00:04:29,090
LET'S SEE.

70
00:04:29,090 --> 00:04:30,190
OKAY.

71
00:04:30,190 --> 00:04:35,430
ALL RIGHT HOW ABOUT THE IDEA
MUCH GOING OUT, LANDING ON AN

72
00:04:35,430 --> 00:04:38,240
DESTROYED, PICKING UP A BOULDER
AND BRINGING IT BACK TOWARDS

73
00:04:38,240 --> 00:04:39,240
EARTH?

74
00:04:39,240 --> 00:04:40,910
PRETTY GOOD.

75
00:04:40,910 --> 00:04:44,890
THEY PRETTY MUCH AGREE WITH THAT
HAPPENING.

76
00:04:44,890 --> 00:04:48,450
SO TELL US WHICH OF THOSE IDEAS
WAS CHOSEN.

77
00:04:48,450 --> 00:04:49,450
>> ABSOLUTELY.

78
00:04:49,450 --> 00:04:53,600
WE DID DECIDE TO GO WITH THE
OPTION TO TRAVEL TO A LARGE

79
00:04:53,600 --> 00:04:58,310
ASTEROID, AND EXTRACT A
MULTI-TON BOULDER OR COHESIVE

80
00:04:58,310 --> 00:05:01,770
MASS FROM THE SURFACE OF THAT
ASTEROID AND THEN ACTUALLY

81
00:05:01,770 --> 00:05:06,040
PERFORM A DEMONSTRATION OF A
PRECISION DEFLECTION MANEUVER OF

82
00:05:06,040 --> 00:05:09,740
A LARGER ASTEROID AND BRING THAT
BOULDER BACK TO THE LUNAR

83
00:05:09,740 --> 00:05:10,740
VICINITY.

84
00:05:10,740 --> 00:05:12,900
>> A PRECISION DEMONSTRATION.

85
00:05:12,900 --> 00:05:15,289
TELL ME WHAT THAT IS.

86
00:05:15,289 --> 00:05:18,819
>> WHAT WE'LL DO IS UTILIZE THE
GRAVITATIONAL FORCE CREATED BY

87
00:05:18,819 --> 00:05:22,990
BOTH THE SPACECRAFT AND THE
MULTI-TON BOULDER TOGETHER TO

88
00:05:22,990 --> 00:05:28,169
SLOWLY AND PRECISELY HOPEFULLY

WE'LL MERIT, ALTER THE

89
00:05:28,169 --> 00:05:31,660
TRAJECTORY OF THE LARGE ASTEROID
WHILE IT'S HURTLING THROUGH

90
00:05:31,660 --> 00:05:34,760
SPACE.

91
00:05:34,760 --> 00:05:37,110
>> SO IF THERE'S AN ASTEROID
HEADING TOWARDS EARTH MAYBE WE

92
00:05:37,110 --> 00:05:41,180
CAN NUDGE IT A LITTLE BIT SO IT
MISSES EARTH?

93
00:05:41,180 --> 00:05:45,699
>> IT WILL BE A DEMONSTRATION OF
ONE TYPE OF DEFLECTION.

94
00:05:45,699 --> 00:05:48,430
>> WHAT ARE THE OTHER
CHALLENGES?

95
00:05:48,430 --> 00:05:53,650
>> SO, THE ROBOTIC SPACECRAFT
WHICH YOU CAN SEE HERE ON THE

96
00:05:53,650 --> 00:05:58,910
FRONT END OF THIS MODEL IS
POWERED BY ADVANCE SOD LAR

97
00:05:58,910 --> 00:06:01,780
ELECTRICAL PROPULSION WHICH IS A
COMBINATION OF ADVANCED

98
00:06:01,780 --> 00:06:09,070
TECHNOLOGIES INCLUDING HIGH
POWER SOLAR RAY, LONG LIFE ION

99
00:06:09,070 --> 00:06:14,360
THRUSTERS AND POWER PROCESSING
AND CONVERSION TECHNOLOGY.

100
00:06:14,360 --> 00:06:16,410
INTEGRATION OF THESE
TECHNOLOGIES THAT PROVIDES THE

101
00:06:16,410 --> 00:06:22,319
REAL ENABLING SYSTEM FOR THIS
DEMONSTRATION AS WELL AS THE

102
00:06:22,319 --> 00:06:23,890
INTEGRATED MOVING MASS.

103
00:06:23,890 --> 00:06:30,940
>> A LOT
OF THIS IS BRAND NEW

104
00:06:30,940 --> 00:06:32,260
TECHNOLOGY.

105
00:06:32,260 --> 00:06:33,580
>> YES.

106
00:06:33,580 --> 00:06:34,910
FIRST TIME IT'S FLOWN.

107
00:06:34,910 --> 00:06:36,180
CAPABILITY DEMONSTRATION.

108
00:06:36,180 --> 00:06:37,840
>> THAT'S AWESOME.

109
00:06:37,840 --> 00:06:42,550
SO TELL ME SOMETHING ELSE ABOUT
THIS MISSION.

110
00:06:42,550 --> 00:06:45,979
THE SOLAR PANELS ARE SUPER HIGH
POWERED?

111
00:06:45,979 --> 00:06:49,550
>> MUCH HIGH POWERED THAN
ANYTHING WE'VE FLOWN BEFORE.

112
00:06:49,550 --> 00:06:50,550
>> THAT'S AWESOME.

113
00:06:50,550 --> 00:06:53,160
I LOVE THE IDEA YOU GUYS ARE
CREATING NEW TECHNOLOGY AND

114
00:06:53,160 --> 00:06:56,830
PUTTING THEM TOGETHER IN A WAY
WE'RE ABLE TO DO ALL KIND OF

115
00:06:56,830 --> 00:06:57,830
DIFFERENT THINGS.

116
00:06:57,830 --> 00:06:59,289
YOU READY TO TAKE SOME
QUESTIONS?

117
00:06:59,289 --> 00:07:01,389
WE'LL START WITH A VIDEO
QUESTION.

118
00:07:01,389 --> 00:07:02,479
>> HI.

119
00:07:02,479 --> 00:07:07,599
MY QUESTION IS WHEN WILL YOU BE
ABLE TO GET ASTEROIDS TO EARTH.

120
00:07:07,599 --> 00:07:13,479
>> IN ADDITION TO THE SOLAR

ELECTRIC PROPULSION THERE'S A

121
00:07:13,479 --> 00:07:17,030
CAPTURE SYSTEM ON THE FRONT END
OF THIS MODEL.

122
00:07:17,030 --> 00:07:18,630
AND WILL BE ON THE SPACECRAFT.

123
00:07:18,630 --> 00:07:25,350
A CAPTURE SYSTEM INCLUDES TWO
SOPHISTICATED MATURE ROBOTIC ARM

124
00:07:25,350 --> 00:07:33,620
SYSTEM AND A RESTRAINT SYSTEM
FROM SENSORS WITH OTHER

125
00:07:33,620 --> 00:07:34,930
APPLICATIONS.

126
00:07:34,930 --> 00:07:39,710
WE'RE TRYING TO INFUSE
COMMONALITY AND EFFICIENCY AND

127
00:07:39,710 --> 00:07:43,120
OUR BUILD FAST AT NASA.

128
00:07:43,120 --> 00:07:46,960
IT'S THE COMBINATION OF THOSE
TECHNOLOGIES THAT ALLOW US TO

129
00:07:46,960 --> 00:07:58,669
GRAFT AND ACINQUIRE AND BRING IT
BACK TO THE AIRCRAFT.

130
00:07:58,669 --> 00:08:02,100
>> HOW LONG WILL IT TAKE TO GET
TO THE ASTEROID.

131

00:08:02,100 --> 00:08:04,099
>> THANKS VERY MUCH.

132
00:08:04,099 --> 00:08:07,420
SO CURRENT TRAJECTORY PLAN IS
APPROXIMATELY 18 MONTHS.

133
00:08:07,420 --> 00:08:08,970
IT'S NOT A SHORT MISSION.

134
00:08:08,970 --> 00:08:12,330
THAT IS ONE OF THE ADVANTAGES OF
UTILIZING SOLAR ELECTRICAL

135
00:08:12,330 --> 00:08:22,490
PROPULSION IS IT PROVIDES
FLEXIBILITY BY ALLOWING A VERY

136
00:08:22,490 --> 00:08:28,599
LOW THRUST WHICH IS A RATHER
SLOWER AND MORE FLEXIBLE

137
00:08:28,599 --> 00:08:32,569
THRUSTING TECHNIQUE THAN WE USE
WITH OUR BIG ENGINES.

138
00:08:32,569 --> 00:08:35,130
>> WE HAVE AN ONLINE QUESTION
NEXT.

139
00:08:35,130 --> 00:08:39,209
WHY DOES THE ENGINE ON THE
SPACECRAFT GLOW BRIGHT BLUE.

140
00:08:39,209 --> 00:08:40,800
>> THAT'S INTERESTING.

141
00:08:40,800 --> 00:08:45,330
SO THE EXHAUST CHEMICALS
COMBINED WITH THE ATMOSPHERIC

142
00:08:45,330 --> 00:08:48,040
CONSTITUENTS CAUSE COLOR.

143
00:08:48,040 --> 00:08:51,300
OUR EYES PERCEIVE COLOR.

144
00:08:51,300 --> 00:08:52,730
>> AWESOME.

145
00:08:52,730 --> 00:08:55,160
RECENTLY WE HAD AN OPPORTUNITY
TO GO TO GODDARD SPACE FLIGHT

146
00:08:55,160 --> 00:08:59,860
CENTRE AND BETH TALKED TO ONE OF
THE LEADING ENGINEERS.

147
00:08:59,860 --> 00:09:01,750
LET'S GO CHECK THAT OUT.

148
00:09:01,750 --> 00:09:09,900
>> I AM AT NASA'S GODDARD SPACE
FLIGHT CENTRE AND I'M WITH BEAU.

149
00:09:09,900 --> 00:09:15,770
WE'VE GOT THIS VERY COMPLEX
THING HERE.

150
00:09:15,770 --> 00:09:17,860
DO YOU WANT TO TELL ME WHAT THIS
IS?

151
00:09:17,860 --> 00:09:18,860
>> SURE.

152
00:09:18,860 --> 00:09:25,410
THIS IS A MICROSPINE TOOL, THE
TOOL WE USE TO CAPTURE A BOULDER

153
00:09:25,410 --> 00:09:28,200
OFF THE SURFACE OF AN ASTEROID.

154
00:09:28,200 --> 00:09:34,340
THIS VERSION IT HAS 24 PAWS AND
EACH OF THESE PAWS HAVE SEVERAL

155
00:09:34,340 --> 00:09:38,100
FISH HOOKS AT THE END OF IT,
SOMETHING LIKE 2,000 FISH HOOKS

156
00:09:38,100 --> 00:09:45,000
TOTAL AND THEY GRAB THE BOULDER
TO LIFT IT OFF THE ASTEROID

157
00:09:45,000 --> 00:09:46,000
SURFACE.

158
00:09:46,000 --> 00:09:51,190
>> HOW DO THEY WORK
>> THEY ARE INDIVIDUALLY MOUNTED

159
00:09:51,190 --> 00:09:55,910
ON THE SPRINGS SO THAT THEY CAN
MOVE KIND OF LIKE CAT'S PAW,

160
00:09:55,910 --> 00:09:59,940
ALTHOUGH EXCEPT WE'RE NOT TRYING
RETRACT THEM SO WE DON'T SCRATCH

161
00:09:59,940 --> 00:10:06,070
OURSELVES, WE MAKE THEM SO WE
GET AS MANY OF THEM TO GRASP THE

162
00:10:06,070 --> 00:10:08,590
LITTLE FEATURES OF THE BOULDER
AS POSSIBLE.

163

00:10:08,590 --> 00:10:13,390
SO THIS TOOL IS PLACED ON THE
BOULDER BY THE ROBOT ARM.

164
00:10:13,390 --> 00:10:18,050
THESE PAWS ARE LOWERED DOWN ON
TO THE SURFACE AND RETRACTED AND

165
00:10:18,050 --> 00:10:21,400
SO THAT WE GRASP THE ROCK
FEATURES.

166
00:10:21,400 --> 00:10:25,800
>> NOW, THIS LOOKS VERY COMPLEX.

167
00:10:25,800 --> 00:10:28,300
SO WHAT ARE SOME OF THE
CHALLENGES THAT YOU HAVE TO GO

168
00:10:28,300 --> 00:10:31,630
THROUGH TO MAKE SOMETHING LIKE
THIS TO JUST LIFT THE BOULDER

169
00:10:31,630 --> 00:10:33,000
OFF AN ASTEROID?

170
00:10:33,000 --> 00:10:36,960
>> THIS IS A VERY COMPLICATED
MECHANICAL DEVICE.

171
00:10:36,960 --> 00:10:41,330
A LOT OF WORK HAS TO GO INTO
MAKING THE VERY PRECISE

172
00:10:41,330 --> 00:10:46,090
MEASUREMENTS AND METAL PIECES
INSIDE.

173
00:10:46,090 --> 00:10:48,900
IT HAS SEVEN DIFFERENT FUNCTIONS

IT PROVIDES.

174
00:10:48,900 --> 00:10:52,880
I TOLD YOU ABOUT 2005 THEM.

175
00:10:52,880 --> 00:10:54,610
ONE IS THE PULL END.

176
00:10:54,610 --> 00:10:56,380
IN THE FLIGHT VERSE IT WILL HAVE
A DRILL.

177
00:10:56,380 --> 00:11:01,280
IT DRILLS INTO THE ROCK FROM
PROVIDE ADDITIONAL ANCHORING.

178
00:11:01,280 --> 00:11:04,680
AFTER IT DRILLS IT ALSO HAMMERS
TO GET DOWN INTO THE ROCK SO IF

179
00:11:04,680 --> 00:11:07,200
YOU EVER TRY TO DRILL INTO
CEMENT YOU KNOW THAT'S

180
00:11:07,200 --> 00:11:08,760
DIFFICULT.

181
00:11:08,760 --> 00:11:12,540
THIS TOOL HAS TO ACCOMMODATE A
WIDE VARIETY OF ROCK SURFACE,

182
00:11:12,540 --> 00:11:15,200
ROCK TYPES.

183
00:11:15,200 --> 00:11:18,940
WE KNOW A GOOD AMOUNT OF
ASTEROIDS BUT ONE THING WE KNOW

184
00:11:18,940 --> 00:11:22,691

IS THERE'S VARIETY AND WE WON'T
KNOW WHAT THIS ROCK WILL LOOK

185
00:11:22,691 --> 00:11:24,170
LIKE UNTIL WE GET THERE.

186
00:11:24,170 --> 00:11:28,430
THAT TOOL HAS TO ACCOMMODATE A
WIDE RANGE.

187
00:11:28,430 --> 00:11:36,790
WE'RE 30 MINUTES AWAY ROUND TRIP
BY LIGHT FROM EARTH, SO THE

188
00:11:36,790 --> 00:11:41,890
ENTIRE SEQUENCE TO DESCEND DOWN
TO THE SURFACE IS AUTONOMOUS AND

189
00:11:41,890 --> 00:11:44,000
THE SPACECRAFT DOES IT ALL BY
ITSELF.

190
00:11:44,000 --> 00:11:47,920
>> THAT IS REALLY COOL.

191
00:11:47,920 --> 00:11:49,490
>> YEAH.

192
00:11:49,490 --> 00:11:52,680
>> THAT INTERVIEW WAS GRIPPING,
BUT THAT'S NOT THE ONLY PART OF

193
00:11:52,680 --> 00:11:53,680
THE MISSION.

194
00:11:53,680 --> 00:11:56,130
THE NEXT PART OF THE MISSION IS
ACTUALLY TO SEND ASTRONAUTS OUT

195

00:11:56,130 --> 00:11:58,590
TO THE PIECE OF THE ASTEROID
THAT WE BRING BACK AND PUT IT

196
00:11:58,590 --> 00:11:59,810
AROUND THE ORBIT OF THE MOON.

197
00:11:59,810 --> 00:12:02,940
TELL US ABOUT THAT.

198
00:12:02,940 --> 00:12:11,690
>> THE ACTIVE END OF THIS IS THE
ORION SPACE CAPSULE AND OUR PLAN

199
00:12:11,690 --> 00:12:20,350
IS TO -- WE PLAN IT -- IS TO
TAKE THE ASTRONAUTS ON THE SPACE

200
00:12:20,350 --> 00:12:25,280
CAPSULE APPROXIMATELY 75,000
KILOMETERS FURTHER FROM THE MOON

201
00:12:25,280 --> 00:12:28,490
WHICH IS ABOUT 45,000 MILES
FURTHER THAN WE'VE EVER TAKEN

202
00:12:28,490 --> 00:12:29,930
ASTRONAUTS BEFORE.

203
00:12:29,930 --> 00:12:40,430
ROUNDEVOUS WITH THIS VEHICLE
TO

204
00:12:40,430 --> 00:12:44,340
SELECT SAMPLES, ACINQUIRE
SAMPLE, CONTAIN SAMPLES AND

205
00:12:44,340 --> 00:12:47,870
RETURN THEM TO THE EARTH WITH
THE CREW IN THE ORION CAPSULE.

206
00:12:47,870 --> 00:12:50,340
>> WHEN WE LOOK AT THIS MODEL
WE'RE LOOKING AT TWO SEPARATE

207
00:12:50,340 --> 00:12:55,490
SPACECRAFTS ONE TO THE ASTEROID,
THE OTHER TO THE CREW AND DOCK

208
00:12:55,490 --> 00:12:56,540
WITH IT.

209
00:12:56,540 --> 00:13:00,960
>> IT'S THE ABILITY TO SEPARATE
THOSE FUNCTIONS INTO TWO

210
00:13:00,960 --> 00:13:05,910
SEPARATE SPACECRAFTS THAT ALLOW
US TO DO A NUMBER OF THINGS.

211
00:13:05,910 --> 00:13:11,910
ONE IS TO LOWER THE RISK TO THE
CREW WHILE LOWERING THE COST TO

212
00:13:11,910 --> 00:13:17,670
THE PORTION OF THE MISSION THAT
ACTUALLY PERFORMS THE PORTION

213
00:13:17,670 --> 00:13:21,720
THAT IS LESS NECESSARY TO HAVE
THE CREW FOR BUT PROVIDE AN

214
00:13:21,720 --> 00:13:24,430
INTEGRATED CAPABILITY
DEMONSTRATION FOR US TO CONTINUE

215
00:13:24,430 --> 00:13:27,880
TO TAKE OUR ASTRONAUTS FURTHER
AND FURTHER THAN WE HAVE EVER

216
00:13:27,880 --> 00:13:29,080
BEFORE.

217
00:13:29,080 --> 00:13:32,590
>> RECENTLY I HAD AN OPPORTUNITY
TO TALK WITH ASTRONAUT RANDY

218
00:13:32,590 --> 00:13:35,460
ABOUT SOME OF THE TRAINING THAT
HE'S DONE TO ACTUALLY GO OUT THE

219
00:13:35,460 --> 00:13:36,460
AN ASTEROID.

220
00:13:36,460 --> 00:13:38,190
SO LET'S CHECK THAT OUT.

221
00:13:38,190 --> 00:13:40,790
>> I'M JOINED TODAY BY RANDY.

222
00:13:40,790 --> 00:13:42,610
HE'S A SPACE SHUTTLE ASTRONAUT.

223
00:13:42,610 --> 00:13:46,550
HE DID TWO SPACE WALKS THAT
TOTALLED OVER 11 HOURS IN SPACE.

224
00:13:46,550 --> 00:13:48,360
THANK YOU SO MUCH FOR JOINING US
TODAY.

225
00:13:48,360 --> 00:13:49,770
>> MY PLEASURE.

226
00:13:49,770 --> 00:13:51,640
>> THERE ARE SOME CHALLENGES
WHEN YOU DO A SPACEWALK.

227

00:13:51,640 --> 00:13:53,690
CAN YOU TELL US ABOUT THOSE?

228
00:13:53,690 --> 00:13:58,000
>> FIRST, WE HAVE TO HAVE A
SPACESHIP TO GO OUTSIDE.

229
00:13:58,000 --> 00:14:01,410
BREATHABLE ATMOSPHERE, MAINTAIN
THE TEMPERATURE BECAUSE AS YOU

230
00:14:01,410 --> 00:14:06,140
KNOW, IT'S PLUS 250 DEGREES IN
THE SUN AND MINUS 250 DEGREES IN

231
00:14:06,140 --> 00:14:07,140
THE SHADE.

232
00:14:07,140 --> 00:14:09,820
THAT 500 TEMPERATURE CHANGE IS
TOUGH TO OVERCOME MECHANICALLY.

233
00:14:09,820 --> 00:14:14,920
>> WHAT ARE THE CHALLENGES FOR A
SPACEWALK THAT'S WAY OUT FROM

234
00:14:14,920 --> 00:14:15,950
EARTH.

235
00:14:15,950 --> 00:14:25,480
>> WE HAVE RADIATION BELTS TO
PROTECT US FROM COSMIC

236
00:14:25,480 --> 00:14:26,870
RADIATION.

237
00:14:26,870 --> 00:14:32,170
OUTSIDE OF RADIATION BELTS,
LUNAR ORBIT WE DON'T HAVE THAT.

238
00:14:32,170 --> 00:14:35,710
EDUCATION EXPOSURE IN THOSE
SUITS WILL BE A LOT MORE.

239
00:14:35,710 --> 00:14:40,250
WE NEED SUITS DESIGNED FOR
HIGHER RADIATION ENVIRONMENT.

240
00:14:40,250 --> 00:14:45,410
I THINK PSYCHOLOGICALLY, THE
HUMAN PART, THE HARDER PART IS

241
00:14:45,410 --> 00:14:50,580
THE FACT THAT YOU DON'T HAVE
EARTH, THIS BIG HUGE BALL RIGHT

242
00:14:50,580 --> 00:14:51,580
THERE.

243
00:14:51,580 --> 00:14:56,860
SO EVEN THOUGH YOU'RE 225 MILES
UP, YOU HAVE THE FEELING YOU'RE

244
00:14:56,860 --> 00:14:57,860
TIED TO EARTH.

245
00:14:57,860 --> 00:15:02,000
THE MOON GUYS, THEY CAN PUT
THEIR THUMB UP AND COVER THE

246
00:15:02,000 --> 00:15:05,450
EARTH AND YOU'RE NOT FAR AWAY
YOU DON'T HAVE THE EARTH THERE.

247
00:15:05,450 --> 00:15:08,670
THAT MIGHT BE A DIFFERENT
SENSATION FROM THE FOLLOWING ONE

248
00:15:08,670 --> 00:15:10,270

US HAVE TO OVERCOME.

249
00:15:10,270 --> 00:15:14,740
>> YOU'VE DONE SOME TRAINING
FOR WORKING ON AN ASTEROID,

250
00:15:14,740 --> 00:15:15,740
CORRECT?

251
00:15:15,740 --> 00:15:16,740
>> CORRECT.

252
00:15:16,740 --> 00:15:25,740
WE LIVE IN THE HABITAT OFF THE
COAST OF FLORIDA, UNDERSEA

253
00:15:25,740 --> 00:15:31,240
HABITAT IN THE WORLD AND WE LIVE
THERE FOR A WEEK UNDER GROUND.

254
00:15:31,240 --> 00:15:36,800
PART OF OUR TIME WAS DEDICATED
TO EQUIPMENT EXPLORATION THAT

255
00:15:36,800 --> 00:15:38,610
ALLOWS US TO DO WORK ON AN
ASTEROID.

256
00:15:38,610 --> 00:15:39,960
ASTEROIDS ARE SMALL.

257
00:15:39,960 --> 00:15:41,910
THEY DON'T HAVE GRAVITY.

258
00:15:41,910 --> 00:15:45,250
IF WE GO UP TO AN ASTEROID AND
ONE SMALL ENOUGH WE CAN DO

259
00:15:45,250 --> 00:15:50,220

REDIRECT MISSION AND BRING IT
BACK TO THE EARTH, IF WE GO UP

260
00:15:50,220 --> 00:15:52,171
TO IT WE'LL PUSH IT AND IT MAY
PUSH AWAY.

261
00:15:52,171 --> 00:15:55,800
WE'LL BE OPPOSING EACH OTHER.

262
00:15:55,800 --> 00:15:59,560
SO WHAT WE DID, WORKED OUT A
SYSTEM WHERE WE CAN BOLT DOWN

263
00:15:59,560 --> 00:16:03,880
THE SURFACE OF THE ASTEROID AND
USING A TELESCOPING ARM, DRILL

264
00:16:03,880 --> 00:16:08,160
AND GET CORE SAMPLES.

265
00:16:08,160 --> 00:16:09,850
>> THAT SEEMS LIKE THAT WILL BE
A CHALLENGING MISSION.

266
00:16:09,850 --> 00:16:11,950
WOULD YOU LIKE TO BE ON THAT
MISSION?

267
00:16:11,950 --> 00:16:12,950
>> ABSOLUTELY.

268
00:16:12,950 --> 00:16:15,270
ALL THE ASTRONAUTS WANT TO DO
THE HARD STUFF YOU HAVEN'T DONE

269
00:16:15,270 --> 00:16:16,270
BEFORE.

270

00:16:16,270 --> 00:16:20,000
THAT'S THE FUN THING ABOUT
LEARNING IS THE FACT SOMETHING

271
00:16:20,000 --> 00:16:23,240
INTERESTING TO YOU, YOU GO
STUDY, WORK HARD AND THEN

272
00:16:23,240 --> 00:16:26,290
HOPEFULLY IN TEND EITHER FIND
THE ANSWER OR IN THIS CASE WITH

273
00:16:26,290 --> 00:16:30,780
EXPLORATION DEVELOP AN FIGURE
OUT HOW WE GO FURTHER BASED ON

274
00:16:30,780 --> 00:16:31,950
THE ANSWERS WE FIND.

275
00:16:31,950 --> 00:16:34,230
>> THANK YOU SO MUCH FOR TALKING
WITH US TODAY.

276
00:16:34,230 --> 00:16:35,950
>> MY PLEASURE.

277
00:16:35,950 --> 00:16:39,440
>> SO I'M SITTING HERE WITH MY
FRIENDS.

278
00:16:39,440 --> 00:16:44,140
NOW WE JUST HEARD AN ASTRONAUT
TALK ABOUT TRAVELING INTO SPACE.

279
00:16:44,140 --> 00:16:47,580
HOW MANY OF YOU WOULD LIKE TO BE
ON ONE OF THESE MISSIONS?

280
00:16:47,580 --> 00:16:51,880
LET'S SEE GO, NO GO.

281
00:16:51,880 --> 00:16:53,660
I THINK WE HAVE A LOT OF GOS.

282
00:16:53,660 --> 00:16:59,070
WE HAVE A LOT OF PEOPLE WHO DO
WANT TO BE ASTRONAUTS.

283
00:16:59,070 --> 00:17:02,720
YOU ALL HAD A CHANCE TO MEET
WITH MARTY, RIGHT?

284
00:17:02,720 --> 00:17:04,810
HE CAME TO YOUR SCHOOL.

285
00:17:04,810 --> 00:17:07,740
CAN YOU TELL US WHAT HE DID?

286
00:17:07,740 --> 00:17:11,780
>> WELL WE STUDIED MORE WITH
METEORITES AND WHERE THEY COME

287
00:17:11,780 --> 00:17:18,360
FROM AND WE STEW DID ROCKS AND
THE TEXTURE OF IT WAS VERY

288
00:17:18,360 --> 00:17:19,360
SMOOTH.

289
00:17:19,360 --> 00:17:23,910
WE WERE ABLE TO USE MAGNETS TO
ATTRACT THE P PIECES OF THE

290
00:17:23,910 --> 00:17:26,330
METEORITES.

291
00:17:26,330 --> 00:17:31,790
>> LET'S LOOK WHAT WE DID.

292
00:17:31,790 --> 00:17:34,530
>> TODAY YOUR GUYS READY TO
BECOME GEOLOGISTS?

293
00:17:34,530 --> 00:17:35,530
>> YES.

294
00:17:35,530 --> 00:17:39,950
>> WE'RE GOING TO CHECK OUT SOME
ROCKS BUT THESE AREN'T ORDINARY

295
00:17:39,950 --> 00:17:41,110
EVERY DAY ROCKS.

296
00:17:41,110 --> 00:17:45,170
THESE ROCKS ARE FROM OUTER
SPACE.

297
00:17:45,170 --> 00:17:46,950
>> OH.

298
00:17:46,950 --> 00:17:51,060
>> THESE ARE ALL METEORITES,
CHUNKS OF ASTEROIDS AT SOME

299
00:17:51,060 --> 00:17:54,720
POINT FELL TO THE EARTH'S
SURFACE AND WE FOUND THEM AND

300
00:17:54,720 --> 00:17:57,680
NOW WE CAN STUDY THEM TO LEARN
ABOUT OUR EARLY SOLAR SYSTEM.

301
00:17:57,680 --> 00:17:59,650
ARE YOU READY TO CHECK THIS OUT?

302
00:17:59,650 --> 00:18:00,650
>> YES.

303
00:18:00,650 --> 00:18:01,650
>> ALL RIGHT.

304
00:18:01,650 --> 00:18:12,740
LET'S DO IT.

305
00:18:12,740 --> 00:18:16,980
SO THIS WAS ORIGINALLY A
METEORITE MADE UP OF A WHOLE

306
00:18:16,980 --> 00:18:20,650
BUNCH OF FIBERS LIKE THIS AND
THEY SLICED IT SO THEY COULD

307
00:18:20,650 --> 00:18:25,520
STUDY THE INSIDE OF IT.

308
00:18:25,520 --> 00:18:36,820
METEORITES ARE MADE OF ALL KINDS
OF DIFFERENT THINGS.

309
00:18:36,820 --> 00:18:40,780
THIS ONE IS MOSTLY MADE OF ROCK.

310
00:18:40,780 --> 00:18:44,250
SO WHAT WE KNOW FROM THIS ONE
IS, THIS TYPE OF METEORITE WAS

311
00:18:44,250 --> 00:18:49,730
PROBABLY FROM THE OUTSIDE LAYER
OF AN ASTEROID.

312
00:18:49,730 --> 00:18:54,750
WHERE THIS ONE THAT'S MOSTLY --
FEEL THAT -- MOSTLY METAL, IRON,

313
00:18:54,750 --> 00:19:00,280
VERY HEAVY, IT'S MOST LIKELY
FROM THE INSIDE OF AN ASTEROID.

314
00:19:00,280 --> 00:19:04,000
WHAT'S REALLY COOL HERE ON EARTH
WE DON'T REALLY HAVE ROCKS FROM

315
00:19:04,000 --> 00:19:06,310
THE VERY INSIDE OF THE EARTH, DO
WE?

316
00:19:06,310 --> 00:19:10,250
BUT HERE WE HAVE A ROCK FROM THE
INSIDE OF AN ASTEROID.

317
00:19:10,250 --> 00:19:13,820
AND WE CAN LEARN A LITTLE BIT
ABOUT HOW THAT ASTEROID WAS

318
00:19:13,820 --> 00:19:21,020
FORMED OR WHAT THAT'S MADE OUT
OF.

319
00:19:21,020 --> 00:19:29,570
>> GUYS, DID YOU THINK IT WAS
PRETTY COOL GETTING A CHANCE TO

320
00:19:29,570 --> 00:19:32,750
HOLD ROCKS FROM OUTER SPACE
>> YES.

321
00:19:32,750 --> 00:19:35,750
>> THEY WERE A LOT HEAVIER THAN
THEY LOOKED, WEREN'T THEY?

322
00:19:35,750 --> 00:19:36,750
>> YES.

323
00:19:36,750 --> 00:19:37,760
>> SO GOOD JOB TODAY.

324

00:19:37,760 --> 00:19:43,809
I GOT TO SAY YOU GUYS AND YOUR
OBSERVATIONAL SKILLS, YOU ROCK.

325
00:19:43,809 --> 00:19:46,000
>> THANK YOU.

326
00:19:46,000 --> 00:19:47,410
>> AND I'M HERE WITH LINDSAY
JOHNSON.

327
00:19:47,410 --> 00:19:49,230
HOW ARE YOU TODAY?

328
00:19:49,230 --> 00:19:50,280
>> GOOD.

329
00:19:50,280 --> 00:19:53,590
>> YOU'RE GOING TO TELL US A
LITTLE BIT ABOUT ASTEROIDS.

330
00:19:53,590 --> 00:19:55,260
>> YES.

331
00:19:55,260 --> 00:19:58,110
MIGHT ASK WHY ARE WEINTERESTED
IN EXPLORING ASTEROIDS.

332
00:19:58,110 --> 00:20:07,180
ASTEROIDS ARE
LITERALLY THE

333
00:20:07,180 --> 00:20:09,520
CONSTRUCTION MATERIALS OF THE
SOLAR SYSTEM.

334
00:20:09,520 --> 00:20:13,620
IF YOU GO BY A BUILDING
CONSTRUCTION SITE YOU SEE THESE

335
00:20:13,620 --> 00:20:17,480
PILES OF SAND AND BRICKS AND
ROCKS.

336
00:20:17,480 --> 00:20:22,170
WELL, AN ASTEROID, I THINK WE
HAVE AN IMAGE OF AN ASTEROID

337
00:20:22,170 --> 00:20:26,090
HERE THAT LOOKS A LOT LIKE
CONSTRUCTION MATERIAL.

338
00:20:26,090 --> 00:20:27,090
>> CEMENT.

339
00:20:27,090 --> 00:20:30,480
>> FROM A CONSTRUCTION SITE.

340
00:20:30,480 --> 00:20:35,480
SO THIS IS MATERIAL THAT OVER
THE COURSE OF THE SOLAR SYSTEM,

341
00:20:35,480 --> 00:20:38,390
BILLIONS OF YEARS IN THE SOLAR
SYSTEM COALESCED TOGETHER AND

342
00:20:38,390 --> 00:20:43,900
HAS GROWN BIGGER AND BIGGER AND
BECOME PLANETS OF THE SOLAR

343
00:20:43,900 --> 00:20:44,900
SYSTEM.

344
00:20:44,900 --> 00:20:48,520
SO BY GOING TO AN ASTEROID AND
SAMPLING MATERIAL AND BRINGING

345
00:20:48,520 --> 00:20:53,930
IT BACK FOR LABORATORY ANALYSIS

WE CAN LITERALLY DETERMINE WHAT

346
00:20:53,930 --> 00:20:58,800
ELEMENTS BUILT UP THE SOLAR
SYSTEM AND BECAME THE PLANETS,

347
00:20:58,800 --> 00:21:06,450
AND MATERIAL THAT POSSIBLY HAS
THE ELEMENTS FOR THE CREATION OF

348
00:21:06,450 --> 00:21:07,450
LIFE.

349
00:21:07,450 --> 00:21:10,900
NOW, THE ASTEROID THAT'S ON THE
IMAGE, THE ONE ASTEROID WE HAD A

350
00:21:10,900 --> 00:21:15,200
SPACECRAFT ACTUALLY GO TO IN
ORBIT AND COLLECT SAMPLES.

351
00:21:15,200 --> 00:21:22,680
IT'S CALLED IKAWA, BY THE
JAPANESE MISSION.

352
00:21:22,680 --> 00:21:26,110
IN REAL LIFE IT'S ABOUT A
QUARTER MILE LONG.

353
00:21:26,110 --> 00:21:30,600
AND SO IT'S ABOUT THE SIZE OF A
FOOTBALL STADIUM.

354
00:21:30,600 --> 00:21:32,970
AND SO THIS IS A 3-D BOTTLE OF
IT.

355
00:21:32,970 --> 00:21:35,800
AS YOU CAN SEE IT HAS BOULDERS
ON THE SURFACE THAT MAKES IT A

356
00:21:35,800 --> 00:21:40,170
PERFECT KIND OF ASTEROID THAT WE
WOULD WANT TO GO WITH THE

357
00:21:40,170 --> 00:21:43,150
ASTEROID REDIRECT MISSION TO
COLLECT SAMPLES.

358
00:21:43,150 --> 00:21:51,510
WE HAVE ANOTHER ASTEROID MISSION
CALLED CYBER REX.

359
00:21:51,510 --> 00:21:52,940
THIS IS A MODEL OF IT.

360
00:21:52,940 --> 00:21:57,590
IT ALSO IS ABOUT A QUARTER OF A
MILE IN SIZE.

361
00:21:57,590 --> 00:22:03,720
BUT IT'S MUCH, LOOKS MUCH DARKER
AND THAT'S A CARBONACIOUS, HAS

362
00:22:03,720 --> 00:22:09,800
CARBON AND WATER AND THOSE KIND
OF MATERIALS POSSIBLY EVEN BY

363
00:22:09,800 --> 00:22:13,820
TAKING SAMPLES AND BRINGING THEM
BACK TO EARTH WE'LL DISCOVER

364
00:22:13,820 --> 00:22:16,789
WHERE THE ELEMENTS, CREATION OF
LIFE CAME FROM.

365
00:22:16,789 --> 00:22:20,429
>> BY STUDYING ASTEROIDS WE
LEARN MORE ABOUT OURSELVES?

366
00:22:20,429 --> 00:22:21,640
>> EXACTLY.

367
00:22:21,640 --> 00:22:24,930
WE ARE THE STUFF OF ASTEROIDS.

368
00:22:24,930 --> 00:22:26,720
>> I THINK WE HAVE SOME
QUESTIONS.

369
00:22:26,720 --> 00:22:28,320
DO WE HAVE A VIDEO QUESTION.

370
00:22:28,320 --> 00:22:29,730
LET'S START THERE.

371
00:22:29,730 --> 00:22:30,730
>> HI.

372
00:22:30,730 --> 00:22:38,410
IS THERE SOME WAY TO FIND OUT
WHERE SPACE ASTEROIDS ARE

373
00:22:38,410 --> 00:22:39,810
FORMED?

374
00:22:39,810 --> 00:22:42,740
>> IS THERE A WAY TO FIND OUT
WHERE ASTEROIDS ARE FORMED IN

375
00:22:42,740 --> 00:22:43,990
SPACE?

376
00:22:43,990 --> 00:22:45,250
>> SURE.

377
00:22:45,250 --> 00:22:48,900
THAT'S ONE OF THE PROGRAMS I

LEAD AT NASA.

378
00:22:48,900 --> 00:22:52,680
THE OBSERVATION PROGRAM WHERE
WE'RE TRYING TO FIND WHERE ALL

379
00:22:52,680 --> 00:22:56,760
THE ASTEROIDS ARE IN THE SOLAR
SYSTEM.

380
00:22:56,760 --> 00:22:59,030
SO WE TAKE THE OBSERVATIONS.

381
00:22:59,030 --> 00:23:02,940
WE DETERMINE WHAT THE ORBITS
CURRENTLY ARE AROUND THE SUN AND

382
00:23:02,940 --> 00:23:08,910
THEN USING MATH, COMPUTERS,
THANKFULLY THE COMPUTERS WE CAN

383
00:23:08,910 --> 00:23:13,560
BACK THOSE ORBITS UP FOR
MILLIONS OF YEARS AND DETERMINE

384
00:23:13,560 --> 00:23:16,720
WHERE IN THE SOLAR SYSTEM THESE
OBJECTS ORIGINATED.

385
00:23:16,720 --> 00:23:19,270
>> WE GOT AN AUDIENCE QUESTION.

386
00:23:19,270 --> 00:23:24,970
DO YOU HAVE YOUR QUESTION READY?

387
00:23:24,970 --> 00:23:25,970
DO YOU?

388
00:23:25,970 --> 00:23:26,970

GOT A QUESTION?

389
00:23:26,970 --> 00:23:27,970
READY?

390
00:23:27,970 --> 00:23:29,760
>> MY QUESTION IS WHY DO
ASTRONAUTS EXIST

391
00:23:29,760 --> 00:23:30,760
>> LET'S TRY THE THIS ONE ON
METEORS.

392
00:23:30,760 --> 00:23:34,120
>> ARE METEORS VALUABLE.

393
00:23:34,120 --> 00:23:36,059
>> ARE METEORITES VALUE RABL?

394
00:23:36,059 --> 00:23:38,000
>> METEORITES ARE VERY VALUABLE.

395
00:23:38,000 --> 00:23:43,700
IT'S LIKE A FREE SAMPLE RETURN.

396
00:23:43,700 --> 00:23:48,230
MATERIAL THAT METEORITES COMES
FROM THE ASTEROIDS AND THE

397
00:23:48,230 --> 00:23:51,700
COMETS IN THE SOLAR SYSTEM WHEN
THEY PASS BY THE EARTH THEY

398
00:23:51,700 --> 00:23:56,050
LEAVE THIS MATERIAL THAT COMES
INTO THE EARTH'S ATMOSPHERE, SO

399
00:23:56,050 --> 00:24:01,180
OUT IN SPACE IT'S AN ASTEROID OR

IF IT'S A SMALL ASTEROID WE CALL

400
00:24:01,180 --> 00:24:02,180
THEM METEORS.

401
00:24:02,180 --> 00:24:06,710
WHEN IT ENTERS THE EARTH'S
ATMOSPHERE IT HAS A BRIGHT TRAIL

402
00:24:06,710 --> 00:24:09,140
AND CALLED A METEOR.

403
00:24:09,140 --> 00:24:13,890
WHEN IT HITS THE GROUND AND
COLLECTED OFF THE SURFACE,

404
00:24:13,890 --> 00:24:15,310
THAT'S A METEORITE.

405
00:24:15,310 --> 00:24:18,100
SO THIS IS MATERIAL THAT'S BEEN
DELIVERED TO THE SURFACE OF THE

406
00:24:18,100 --> 00:24:19,760
EARTH FROM SPACE.

407
00:24:19,760 --> 00:24:20,760
>> OKAY.

408
00:24:20,760 --> 00:24:23,380
LET'S TAKE AN ONLINE QUESTION.

409
00:24:23,380 --> 00:24:27,800
IS NASA WORRIED IF THESE
ASTEROIDS ARE NOT REDIRECTED

410
00:24:27,800 --> 00:24:30,930
SOME WILL COLLIDE WITH EARTH?

411
00:24:30,930 --> 00:24:36,600
>> YEAH, THAT'S THE REAL BASIS
OF OUR PROGRAM IS TO FIND ANY

412
00:24:36,600 --> 00:24:40,440
ASTEROID THAT COULD HIT THE
EARTH BEFORE IT FINDS US.

413
00:24:40,440 --> 00:24:45,750
SO OUR PROGRAM, IT'S BEEN
OPERATING FOR ABOUT, YOU KNOW,

414
00:24:45,750 --> 00:24:47,520
16 YEARS NOW.

415
00:24:47,520 --> 00:24:54,941
AND WE HAVE FOUND OVER 13,000
ASTEROIDS THAT COME, WHAT WE

416
00:24:54,941 --> 00:25:02,550
CALL NEAR EARTH ORBITS AND ABOUT
1600 OF THOSE ARE IN ORBITS THAT

417
00:25:02,550 --> 00:25:06,030
COME CLOSE ENOUGH TO EARTH THAT
WE CONSIDER THEM HAZARDOUS.

418
00:25:06,030 --> 00:25:09,390
WE CONTINUE TO OBSERVE THOSE AND
MAKE SURE WE UNDERSTAND THEIR

419
00:25:09,390 --> 00:25:12,980
ORBITS AND FIND ALL THE REST OF
THEM OUT THERE.

420
00:25:12,980 --> 00:25:17,980
CURRENTLY WE HAVE FOUND ONLY
ABOUT 10% OF THE ASTEROIDS THAT

421

00:25:17,980 --> 00:25:21,790
COULD BE HAZARDOUS TO THE EARTH
AND CAN DO SOME REAL DAMAGE IF

422
00:25:21,790 --> 00:25:23,510
IT HIT THE EARTH.

423
00:25:23,510 --> 00:25:27,570
THIS IS A PROGRAM THAT WILL TAKE
MANY YEARS AND LITERALLY DECADES

424
00:25:27,570 --> 00:25:30,030
TO CATALOG ALL THOSE OBJECTS.

425
00:25:30,030 --> 00:25:32,100
>> THANK YOU SO MUCH FOR JOINING
US TODAY.

426
00:25:32,100 --> 00:25:35,070
WE'RE GOING TO GO BACK TO MARTY
AND MICHELE.

427
00:25:35,070 --> 00:25:37,570
>> SO WE TALKED ABOUT THIS
MISSION BUT ONE OF THE BIG PARTS

428
00:25:37,570 --> 00:25:40,300
OF THIS MISSION IS IT'S A
STEPPING STONE TOWARDS

429
00:25:40,300 --> 00:25:42,120
EVENTUALLY GOING TOWARDS MARS.

430
00:25:42,120 --> 00:25:43,500
HOW IS THAT?

431
00:25:43,500 --> 00:25:48,071
>> SO, THE APPLICATION OF
UTILIZING SOLAR ELECTRIC

432
00:25:48,071 --> 00:25:52,600
PROPULSION TO MOVING MULTI-TON
MASSES AND INTERPLANETARY

433
00:25:52,600 --> 00:25:57,190
SPACE-LIKE TRAJECTORIES AND
ULTIMATELY INTO A LONG TERM

434
00:25:57,190 --> 00:26:01,110
STAGING ORBIT ALLOWS US TO
DEMONSTRATE MOVING MARS CHARGE

435
00:26:01,110 --> 00:26:05,290
JOBS MOVING VEHICLES TO RETURN
THE CREW BACK TO EARTH.

436
00:26:05,290 --> 00:26:09,700
THE INTEGRATION OF THE CREW,
VEHICLE AND ROBOTIC VEHICLE AND

437
00:26:09,700 --> 00:26:14,500
OPERATION OF THAT COMBINED
SYSTEM WHILE WE'RE STILL JUST A

438
00:26:14,500 --> 00:26:18,030
FEW DAYS RETURN NOT TOO FAR YET
ALLOWS US TO DEMONSTRATE THAT

439
00:26:18,030 --> 00:26:21,590
WHOLE INTEGRATED MISSION
OPERATIONS CAPABILITY, SAFETY OF

440
00:26:21,590 --> 00:26:25,250
THE CREW, MAINTAINING RETURN
TIMES IF WE NEED TO GET THE CREW

441
00:26:25,250 --> 00:26:31,090
BACK AND FINALLY I WOULD SAY THE
BEGINNING OF THE EVA OR EXTRA

442
00:26:31,090 --> 00:26:36,940
VEHICULAR ACTIVITY TO TAKE THE
ASTRONAUTS OUTSIDE TO DO USEFUL,

443
00:26:36,940 --> 00:26:38,500
MEANINGFUL TASKS.

444
00:26:38,500 --> 00:26:41,230
PRETTY COMPLICATED TASKS YOU
HAVE TO MAKE SURE THE ASTRONAUTS

445
00:26:41,230 --> 00:26:47,000
HAVE ADEQUATE MOBILITY, ADEQUATE
SYSTEMS IN WHICH TO ACCOMPLISH

446
00:26:47,000 --> 00:26:50,120
THEIR TASKS, CARRY ALONG THEIR
LIFE SUPPORT SYSTEMS IN A

447
00:26:50,120 --> 00:26:54,790
PORTABLE MANNER, TESTING THE
ENCASING THAT PROTECTS THE

448
00:26:54,790 --> 00:26:57,830
HUMANS FROM THE HARSH VACUUM OF
DEEP SPACE.

449
00:26:57,830 --> 00:27:01,200
SO THOSE WILL ALL COMBINE
THROUGH DEMONSTRATION ON THIS

450
00:27:01,200 --> 00:27:05,270
MISSION TO ENABLE US TO TAKE THE
NEXT STEP TO MARS.

451
00:27:05,270 --> 00:27:06,270
>> THAT'S AWESOME.

452
00:27:06,270 --> 00:27:08,140

THANK YOU SO MUCH FOR TALK WITH
US TODAY.

453
00:27:08,140 --> 00:27:11,790
OUR NEXT SHOW IS ALL ABOUT MARS
ON OCTOBER 21st.

454
00:27:11,790 --> 00:27:16,620
CHECK THIS OUT OUR STEM 2nd.

455
00:27:16,620 --> 00:27:21,490
>> HI, I'M BETH WILSON ONE OF
THE HOSTS OF STEM 30.

456
00:27:21,490 --> 00:27:24,960
YOU KNOW THERE'S NOTHING MORE I
LIKE MORE THAN LOOKING AT A

457
00:27:24,960 --> 00:27:29,730
PHOTOGRAPH OF A BEAUTIFUL
SUNSET.

458
00:27:29,730 --> 00:27:32,880
>> HEY, THIS DOESN'T LOOK
FAMILIAR.

459
00:27:32,880 --> 00:27:36,250
>> WELL IT IS THE SUN AND YOU
CAN SEE IT SINKING SLOWLY BEHIND

460
00:27:36,250 --> 00:27:39,940
THE HORIZON RIGHT ALONG THESE
WONDERFUL MOUNTAINS.

461
00:27:39,940 --> 00:27:44,030
YOU CAN ALMOST SMELL THE FRESH
AIR.

462
00:27:44,030 --> 00:27:47,170
HOWEVER, THERE ISN'T ANY AIR.

463
00:27:47,170 --> 00:27:50,250
THIS PHOTOGRAPH WAS TAKEN ON
MARS BY ONE OF THE MARS ROVERS.

464
00:27:50,250 --> 00:27:57,610
IF YOU THINK THIS IS COOL CHECK
OUT OUR NEXT STEM 30.

465
00:27:57,610 --> 00:27:59,870
>> OCTOBER 21st, ALL ABOUT MARS.

466
00:27:59,870 --> 00:28:03,000
NOVEMBER 18th WE TALK TO THE
ASTRONAUTS LIVE ON THE

467
00:28:03,000 --> 00:28:04,850
INTERNATIONAL SPACE STATION.