Hubble and Going Forward to the Moon

1
00:00:04,950 --> 00:00:02,470
we choose to go to the moon in this

2
00:00:07,349 --> 00:00:04,960
decade and do the other things not

3
00:00:08,790 --> 00:00:07,359
because they are easy but because they

4
00:00:13,190 --> 00:00:08,800
are hard

5
00:00:13,200 --> 00:00:19,750
one of humanity's greatest achievements

6
00:00:23,590 --> 00:00:21,429
and one of humanity's greatest

7
00:00:25,670 --> 00:00:23,600
scientific tools the world's most

8
00:00:28,870 --> 00:00:25,680
brilliant astronomers

9
00:00:31,830 --> 00:00:28,880
do miracles with this observatory hubble

10
00:00:34,229 --> 00:00:31,840
is profoundly significant i think for

11
00:00:35,910 --> 00:00:34,239
humanity you might be surprised to learn

12
00:00:38,310 --> 00:00:35,920
that the hubble space telescope and

13
00:00:39,910 --> 00:00:38,320

landing on the moon in 2024 have a lot

14
00:00:42,229 --> 00:00:39,920
to do with each other

15
00:00:44,069 --> 00:00:42,239
in fact when you think of hubble usually

16
00:00:45,029 --> 00:00:44,079
those gorgeous pictures first come to

17
00:00:47,990 --> 00:00:45,039
mind

18
00:00:49,990 --> 00:00:48,000
but after jim garvin's 2005 research

19
00:00:52,069 --> 00:00:50,000
using hubble what have we learned about

20
00:00:54,549 --> 00:00:52,079
prospecting the moon for locations to

21
00:00:56,470 --> 00:00:54,559
establish a human presence for the 2024

22
00:00:58,630 --> 00:00:56,480
artemis mission so hubble's one little

23
00:01:01,189 --> 00:00:58,640
piece of that masterpiece of what we've

24
00:01:03,910 --> 00:01:01,199
been working on for 50 years

25
00:01:05,910 --> 00:01:03,920
so that people can use the moon as as a

26
00:01:13,830 --> 00:01:05,920
special place as mother nature's great

27
00:01:19,190 --> 00:01:16,230
space telescope is in a way

28
00:01:21,749 --> 00:01:19,200
a little like galileo's first telescope

29
00:01:24,149 --> 00:01:21,759
wherever galileo pointed his telescope

30
00:01:26,230 --> 00:01:24,159
he made major new discoveries look at

31
00:01:28,310 --> 00:01:26,240
the moon you find mountains and craters

32
00:01:31,030 --> 00:01:28,320
look at saturn you find rings look at

33
00:01:32,789 --> 00:01:31,040
the milky way you find it is littered

34
00:01:34,230 --> 00:01:32,799
and composed

35
00:01:35,749 --> 00:01:34,240
of stars

36
00:01:37,990 --> 00:01:35,759
every one of these discoveries things

37
00:01:39,590 --> 00:01:38,000
that people had not known before

38
00:01:41,670 --> 00:01:39,600

i think it's going to be very similar

39
00:01:44,230 --> 00:01:41,680
with the space telescope

40
00:01:45,910 --> 00:01:44,240
340 miles above the earth's surface

41
00:01:48,069 --> 00:01:45,920
hubble orbits over the distorting

42
00:01:49,590 --> 00:01:48,079
effects of the atmosphere enabling us to

43
00:01:51,590 --> 00:01:49,600
look deeper into space than any

44
00:01:53,510 --> 00:01:51,600
ground-based telescope

45
00:01:55,670 --> 00:01:53,520
hubble was specially designed to be

46
00:01:57,670 --> 00:01:55,680
upgraded while in space

47
00:02:00,469 --> 00:01:57,680
through five servicing missions over the

48
00:02:02,149 --> 00:02:00,479
years astronauts have repaired restored

49
00:02:03,429 --> 00:02:02,159
and updated hubble to make it better

50
00:02:05,429 --> 00:02:03,439
than ever

51
00:02:07,510 --> 00:02:05,439
the hubble space telescope has taught us

52
00:02:10,309 --> 00:02:07,520
a lot about our place in the universe

53
00:02:12,550 --> 00:02:10,319
but back in 2005 then nasa chief

54
00:02:14,390 --> 00:02:12,560
scientist jim garvin decided to focus

55
00:02:16,390 --> 00:02:14,400
hubble's powerful instruments on

56
00:02:18,710 --> 00:02:16,400
something a little closer to home what

57
00:02:21,510 --> 00:02:18,720
if we use hubble to do what it's best at

58
00:02:23,589 --> 00:02:21,520
be a precision photometer in wavelengths

59
00:02:25,990 --> 00:02:23,599
where it's very convenient the lunar

60
00:02:28,070 --> 00:02:26,000
soils light up like firecrackers if

61
00:02:30,550 --> 00:02:28,080
they're rich in certain minerals and we

62
00:02:32,790 --> 00:02:30,560
know from apollo samples that some of

63
00:02:35,030 --> 00:02:32,800

the lunar soils and rocks are literally

64
00:02:37,750 --> 00:02:35,040
ore bodies and so the idea of using

65
00:02:40,070 --> 00:02:37,760
hubble with this exquisite ultraviolet

66
00:02:41,830 --> 00:02:40,080
imaging capability with the acs

67
00:02:43,190 --> 00:02:41,840
instrument at that point and then maybe

68
00:02:46,229 --> 00:02:43,200
later with others

69
00:02:49,430 --> 00:02:46,239
to target the moan came alive imagine

70
00:02:51,270 --> 00:02:49,440
you're 240 000 miles away from earth

71
00:02:53,350 --> 00:02:51,280
yeah you'll be getting packages from

72
00:02:55,589 --> 00:02:53,360
home every once in a while but you're

73
00:02:57,910 --> 00:02:55,599
gonna need to be self-sufficient too and

74
00:02:59,270 --> 00:02:57,920
that's where hubble comes in we realize

75
00:03:01,509 --> 00:02:59,280
that some of the moon rocks might be

76
00:03:03,589 --> 00:03:01,519
resources if they found them on earth

77
00:03:05,670 --> 00:03:03,599
we'd be mining them so

78
00:03:08,630 --> 00:03:05,680
using the eyes of hubble where it has

79
00:03:10,790 --> 00:03:08,640
exquisite precision and resolution in

80
00:03:12,949 --> 00:03:10,800
ways that go beyond our eyes

81
00:03:15,470 --> 00:03:12,959
beyond normal spacecraft we fly to orbit

82
00:03:17,750 --> 00:03:15,480
planets was an opportunity to use an

83
00:03:19,589 --> 00:03:17,760
astronomical asset

84
00:03:21,750 --> 00:03:19,599
a historical one a cathedral to the

85
00:03:23,990 --> 00:03:21,760
stars to observe the moon in a way where

86
00:03:26,869 --> 00:03:24,000
we could test prospect for these

87
00:03:28,869 --> 00:03:26,879
resources in three places and we were

88
00:03:30,949 --> 00:03:28,879

spectacular beyond success with the

89
00:03:33,589 --> 00:03:30,959
capability of hubble to see things we

90
00:03:36,070 --> 00:03:33,599
couldn't see at finer scales hubble

91
00:03:37,110 --> 00:03:36,080
became a resource prospector to light

92
00:03:39,030 --> 00:03:37,120
the way

93
00:03:40,869 --> 00:03:39,040
for following missions lunar

94
00:03:42,550 --> 00:03:40,879
reconnaissance orbiter to fill in the

95
00:03:44,309 --> 00:03:42,560
gaps to paint the picture of the moon

96
00:03:47,430 --> 00:03:44,319
that we're going to go back to we were

97
00:03:50,309 --> 00:03:47,440
attempting to be catalysts pathfinders

98
00:03:52,550 --> 00:03:50,319
for how we might use the moon in ways

99
00:03:54,229 --> 00:03:52,560
that are more creative than than many

100
00:03:55,990 --> 00:03:54,239
had ever thought they could be used what

101
00:03:59,110 --> 00:03:56,000
if we could live off the moon's

102
00:04:00,550 --> 00:03:59,120
resources in ways that enable us not to

103
00:04:02,390 --> 00:04:00,560
have to bring everything with us and

104
00:04:05,670 --> 00:04:02,400
we'll use the moon as the springboard in

105
00:04:07,830 --> 00:04:05,680
the confidence to go on to mars

106
00:04:10,149 --> 00:04:07,840
but establishing ourselves on the moon

107
00:04:12,550 --> 00:04:10,159
is just the first part of nasa's goal

108
00:04:14,630 --> 00:04:12,560
there are some bigger plans in store for

109
00:04:16,789 --> 00:04:14,640
the future and you can be sure that

110
00:04:18,949 --> 00:04:16,799
hubble is a part of that next journey as

111
00:04:20,229 --> 00:04:18,959
well i'm very excited about the artemis

112
00:04:20,949 --> 00:04:20,239
mission

113
00:04:23,430 --> 00:04:20,959

but

114
00:04:25,670 --> 00:04:23,440
even beyond that the whole

115
00:04:28,150 --> 00:04:25,680
idea is to go to mars so

116
00:04:30,070 --> 00:04:28,160
this whole process is you know about

117
00:04:32,710 --> 00:04:30,080
making sure we can get back to the moon

118
00:04:34,710 --> 00:04:32,720
safely and extending that

119
00:04:36,390 --> 00:04:34,720
to be able to journey to other planets

120
00:04:39,510 --> 00:04:36,400
like mars in the future

121
00:04:41,510 --> 00:04:39,520
and hubble gets to study these objects

122
00:04:43,430 --> 00:04:41,520
in the solar system including mars that

123
00:04:47,030 --> 00:04:43,440
studied weather on mars

124
00:04:50,070 --> 00:04:47,040
regularly and being able to monitor

125
00:04:51,830 --> 00:04:50,080
at great levels of detail these storms

126
00:04:54,870 --> 00:04:51,840
helps us better understand the surface

127
00:04:57,430 --> 00:04:54,880
of mars and where it's safe to land for

128
00:05:00,390 --> 00:04:57,440
example and you know for humans to visit

129
00:05:02,469 --> 00:05:00,400
and so hubble's really been able to help

130
00:05:04,469 --> 00:05:02,479
you know be a part of this journey as

131
00:05:05,749 --> 00:05:04,479
humans get to go from the moon to mars

132
00:05:07,350 --> 00:05:05,759
in that sense

133
00:05:12,310 --> 00:05:07,360
it's about

134
00:05:13,590 --> 00:05:12,320
going out there in the forefront of

135
00:05:15,830 --> 00:05:13,600
technology

136
00:05:18,070 --> 00:05:15,840
and breaking through

137
00:05:20,230 --> 00:05:18,080
and hubble represents that to the

138
00:05:22,390 --> 00:05:20,240

greatest degree that i can think of

139
00:05:24,950 --> 00:05:22,400
because it allows us to do it in a big

140
00:05:27,590 --> 00:05:24,960
way and in a small way allows us to do

141
00:05:30,230 --> 00:05:27,600
it in detectors it allows us to do it in

142
00:05:33,270 --> 00:05:30,240
computer technology in optical

143
00:05:35,590 --> 00:05:33,280
fabrication and optical polishing

144
00:05:38,710 --> 00:05:35,600
but it also gives us this big picture it

145
00:05:45,990 --> 00:05:38,720
also gives us this great challenge of

146
00:05:50,230 --> 00:05:47,670
people everywhere

147
00:05:52,150 --> 00:05:50,240
look up at the same sky and say you know

148
00:05:54,070 --> 00:05:52,160
we're all part of something together

149
00:05:55,830 --> 00:05:54,080
we're all citizens of planet earth and

150
00:05:58,870 --> 00:05:55,840
we're all part of this magnificent

151
00:06:01,430 --> 00:05:58,880
universe and and having some kind of

152
00:06:03,110 --> 00:06:01,440
constructive presence around the moon i

153
00:06:04,950 --> 00:06:03,120
think it will be very exciting for

154
00:06:06,950 --> 00:06:04,960
people around the globe so we are

155
00:06:08,950 --> 00:06:06,960
excited about that and we're excited

156
00:06:11,270 --> 00:06:08,960
about the way science missions and

157
00:06:13,510 --> 00:06:11,280
satellites and probes and telescopes can

158
00:06:15,990 --> 00:06:13,520
complement human space flight

159
00:06:17,189 --> 00:06:16,000
to give us a full suite of information

160
00:06:18,790 --> 00:06:17,199
whether it's

161
00:06:21,189 --> 00:06:18,800
trying to understand how humans can

162
00:06:23,670 --> 00:06:21,199
survive off planet earth or whether it's

163
00:06:26,070 --> 00:06:23,680

just basic curiosity about

164
00:06:28,469 --> 00:06:26,080
how did the earth and the moon form and

165
00:06:30,469 --> 00:06:28,479
how does that compare to planets

166
00:06:32,950 --> 00:06:30,479
outside of our solar system

167
00:06:35,029 --> 00:06:32,960
all of these information gathering

168
00:06:36,710 --> 00:06:35,039
missions are very helpful to our

169
00:06:39,189 --> 00:06:36,720
understanding of who we are as human

170
00:06:41,189 --> 00:06:39,199
beings and to our quest for exploring

171
00:06:42,950 --> 00:06:41,199
space

172
00:06:46,150 --> 00:06:42,960
one object that's in our destiny is the

173
00:06:48,230 --> 00:06:46,160
moat we've been there six times 50 years

174
00:06:50,550 --> 00:06:48,240
ahead of our time with project apollo

175
00:06:53,110 --> 00:06:50,560
we're ready to go back women and men for

176
00:06:54,230 --> 00:06:53,120
the long haul and that that prime

177
00:06:55,270 --> 00:06:54,240
directive

178
00:06:57,189 --> 00:06:55,280
will put

179
00:07:00,150 --> 00:06:57,199
people on the moon again in the year

180
00:07:02,469 --> 00:07:00,160
2024. hubble has been one of those

181
00:07:05,029 --> 00:07:02,479
pieces of the mosaic of information that

182
00:07:07,749 --> 00:07:05,039
help us understand what the moon offers

183
00:07:10,629 --> 00:07:07,759
what we could use the moon for as we're

184
00:07:12,710 --> 00:07:10,639
there so now we could see our universe

185
00:07:14,309 --> 00:07:12,720
our solar system in a new light and now

186
00:07:17,270 --> 00:07:14,319
we're ready to capitalize on that and

187
00:07:19,029 --> 00:07:17,280
that's what artemis what hubble what the

188
00:07:21,110 --> 00:07:19,039

future of space exploration is about

189
00:07:22,950 --> 00:07:21,120
let's capitalize on what we learned

190
00:07:31,180 --> 00:07:22,960
we're out of the dark ages we're coming