1
00:00:18,230 --> 00:00:16,390
we are going to add a shuttle servicing

2
00:00:20,390 --> 00:00:18,240
mission to the hubble space telescope to

3
00:00:31,429 --> 00:00:20,400
the shuttle's manifest to be flown

4
00:00:36,069 --> 00:00:33,270
about 7 35

5
00:00:39,190 --> 00:00:36,079
eastern standard time hubble entered

6
00:00:41,910 --> 00:00:39,200
into inertial hole safe modes he noticed

7
00:00:44,709 --> 00:00:41,920
spikes on the structure current and the

8
00:00:46,389 --> 00:00:44,719
main bus current we believe that this is

9
00:00:48,470 --> 00:00:46,399
indicative of a short circuit that

10
00:00:55,350 --> 00:00:48,480
occurred in the advanced camera for

11
00:01:00,709 --> 00:00:58,549
acs was inserted on hubble in 2002

12
00:01:02,709 --> 00:01:00,719
before it died it was the most heavily

13
00:01:05,990 --> 00:01:02,719

used instrument on hubble

14
00:01:07,109 --> 00:01:06,000
acs was our best survey camera so it was

15
00:01:09,510 --> 00:01:07,119
able to

16
00:01:11,190 --> 00:01:09,520
for example map the distribution of dark

17
00:01:12,789 --> 00:01:11,200
matter and space no one had ever done

18
00:01:14,950 --> 00:01:12,799
that before

19
00:01:17,270 --> 00:01:14,960
acs was critical to our study of dark

20
00:01:19,590 --> 00:01:17,280
energy surveying the

21
00:01:21,510 --> 00:01:19,600
the galaxies out across space for

22
00:01:23,350 --> 00:01:21,520
exploding stars supernovae that would

23
00:01:25,350 --> 00:01:23,360
indicate how far away those galaxies

24
00:01:32,789 --> 00:01:25,360
were and how fast they're moving away

25
00:01:38,710 --> 00:01:36,230
so we were pretty far along on stis

26
00:01:41,270 --> 00:01:38,720
and then acs failed and that was really

27
00:01:42,310 --> 00:01:41,280
late in the game what failed as a power

28
00:01:43,990 --> 00:01:42,320
supply

29
00:01:45,910 --> 00:01:44,000
and in fact in the acs there were two

30
00:01:47,830 --> 00:01:45,920
power supplies one

31
00:01:49,590 --> 00:01:47,840
redundant set of power supplies so one

32
00:01:53,030 --> 00:01:49,600
of them failed and they switched to the

33
00:01:55,670 --> 00:01:53,040
other side and the other one then failed

34
00:01:57,270 --> 00:01:55,680
so there was not much time but it was

35
00:01:59,990 --> 00:01:57,280
decided to see if we could come up with

36
00:02:01,590 --> 00:02:00,000
a fix for it

37
00:02:02,709 --> 00:02:01,600
we leveraged what we learned on this

38
00:02:04,870 --> 00:02:02,719

this job

39
00:02:07,190 --> 00:02:04,880
you know how to get to those components

40
00:02:09,350 --> 00:02:07,200
how to remove large numbers of fasteners

41
00:02:11,350 --> 00:02:09,360
with fastener capture plates how to

42
00:02:13,589 --> 00:02:11,360
build special tools for the astronauts

43
00:02:16,710 --> 00:02:13,599
to do the job

44
00:02:18,390 --> 00:02:16,720
just getting the thing to work in this

45
00:02:20,150 --> 00:02:18,400
amount of time

46
00:02:22,390 --> 00:02:20,160
has been difficult we're running

47
00:02:24,790 --> 00:02:22,400
probably two to three times faster than

48
00:02:27,350 --> 00:02:24,800
a typical program getting things from

49
00:02:29,510 --> 00:02:27,360
concept to design to actual

50
00:02:31,990 --> 00:02:29,520
cutting metal and building things

51
00:02:33,110 --> 00:02:32,000
it has become one of the fortes of our

52
00:02:35,350 --> 00:02:33,120
program

53
00:02:41,030 --> 00:02:35,360
that our people are really really good

54
00:02:45,190 --> 00:02:43,110
removing the card the the cards that

55
00:02:46,949 --> 00:02:45,200
we're taking out are very similar to the

56
00:02:49,030 --> 00:02:46,959
card that's being removed in this disc

57
00:02:51,030 --> 00:02:49,040
repair and in this disk repair they are

58
00:02:52,550 --> 00:02:51,040
going into where the power supply is

59
00:02:53,589 --> 00:02:52,560
because that was also a power supply

60
00:02:55,990 --> 00:02:53,599
failure

61
00:02:57,830 --> 00:02:56,000
so they're taking off 111 screws for

62
00:02:59,750 --> 00:02:57,840
stis and it's

63
00:03:02,949 --> 00:02:59,760

32 for us

64
00:03:04,949 --> 00:03:02,959
we had learned an awful lot on stis we

65
00:03:07,110 --> 00:03:04,959
knew how to get to these places we knew

66
00:03:09,350 --> 00:03:07,120
how to pull covers off we knew how to

67
00:03:11,990 --> 00:03:09,360
pull cards out now the problem was could

68
00:03:20,070 --> 00:03:12,000
we do it where acs

69
00:03:23,110 --> 00:03:21,670
these instruments were never designed to

70
00:03:25,350 --> 00:03:23,120
be opened up

71
00:03:26,949 --> 00:03:25,360
by astronauts in space and certainly not

72
00:03:29,430 --> 00:03:26,959
by astronauts in space working in big

73
00:03:31,509 --> 00:03:29,440
bulky spacesuits

74
00:03:32,869 --> 00:03:31,519
so we needed to make sure that what we

75
00:03:35,190 --> 00:03:32,879
were doing was something that could be

76
00:03:36,869 --> 00:03:35,200
done by an astronaut in zero gravity

77
00:03:38,390 --> 00:03:36,879
with this big puffy suit around them

78
00:03:40,630 --> 00:03:38,400
constraining their movements and not

79
00:03:42,390 --> 00:03:40,640
only that but it's inside what's called

80
00:03:44,789 --> 00:03:42,400
the aft shroud of the hubble space

81
00:03:46,470 --> 00:03:44,799
telescope so there's the space is kind

82
00:03:48,949 --> 00:03:46,480
of confined they have these doors that

83
00:03:51,190 --> 00:03:48,959
they open up and can get in

84
00:03:52,789 --> 00:03:51,200
but where we're actually going in is

85
00:03:53,830 --> 00:03:52,799
kind of they kind of have to reach

86
00:03:55,110 --> 00:03:53,840
around

87
00:03:56,390 --> 00:03:55,120
some of the stuff

88
00:03:57,910 --> 00:03:56,400

and not work right in front of their

89
00:04:00,229 --> 00:03:57,920
faces

90
00:04:02,470 --> 00:04:00,239
the primary detector of the acs what's

91
00:04:04,390 --> 00:04:02,480
known as the wide field channel is a ccd

92
00:04:05,429 --> 00:04:04,400
just like in your digital camera

93
00:04:08,229 --> 00:04:05,439
only it's

94
00:04:10,390 --> 00:04:08,239
16 megapixels so there's a box that

95
00:04:12,390 --> 00:04:10,400
controls that the ceb and that's what

96
00:04:14,229 --> 00:04:12,400
we're taking out and it's probably fine

97
00:04:16,550 --> 00:04:14,239
it actually is probably still working

98
00:04:19,110 --> 00:04:16,560
but that's the easiest way to get in and

99
00:04:20,949 --> 00:04:19,120
get new power into the system

100
00:04:22,550 --> 00:04:20,959
we had to design a

101
00:04:24,230 --> 00:04:22,560
plate that goes on top of where we're

102
00:04:26,710 --> 00:04:24,240
taking off the screws sort of clips on

103
00:04:28,390 --> 00:04:26,720
there and has little holes in them for

104
00:04:29,350 --> 00:04:28,400
the screwdriver to go through

105
00:04:31,430 --> 00:04:29,360
the bit

106
00:04:33,510 --> 00:04:31,440
and those are too small for the screws

107
00:04:35,270 --> 00:04:33,520
to pass through and that was designed

108
00:04:37,030 --> 00:04:35,280
for the stis repair

109
00:04:38,550 --> 00:04:37,040
and they had a very large one with lots

110
00:04:40,550 --> 00:04:38,560
of different types of screws and we were

111
00:04:43,430 --> 00:04:40,560
fortunate that we are in the end only

112
00:04:44,950 --> 00:04:43,440
taking out one size of screw

113
00:04:48,070 --> 00:04:44,960

work we're going in through the top of

114
00:04:50,070 --> 00:04:48,080
this box and there are four circuit

115
00:04:52,230 --> 00:04:50,080
cards in there we'll pull those out and

116
00:04:54,230 --> 00:04:52,240
that leaves us a hole with connectors at

117
00:04:55,909 --> 00:04:54,240
the bottom and those connectors are what

118
00:04:57,749 --> 00:04:55,919
connect to the detector and what used to

119
00:04:59,030 --> 00:04:57,759
supply power to it

120
00:05:00,390 --> 00:04:59,040
and then we'll have a little cartridge

121
00:05:02,070 --> 00:05:00,400
with four new cards in it that will

122
00:05:04,150 --> 00:05:02,080
slide into that space

123
00:05:06,070 --> 00:05:04,160
and that will

124
00:05:07,670 --> 00:05:06,080
allow us to make connections there with

125
00:05:09,670 --> 00:05:07,680
the new cards

126
00:05:11,510 --> 00:05:09,680
but also the power now will come in from

127
00:05:13,350 --> 00:05:11,520
the outside through our external power

128
00:05:18,629 --> 00:05:13,360
supply

129
00:05:21,430 --> 00:05:20,230
it's particularly important to repair

130
00:05:23,990 --> 00:05:21,440
acs

131
00:05:25,830 --> 00:05:24,000
because it together with the new camera

132
00:05:28,310 --> 00:05:25,840
the white field camera three make a

133
00:05:30,550 --> 00:05:28,320
complimentary set they have a full set

134
00:05:33,189 --> 00:05:30,560
of capabilities that astronomers need in

135
00:05:34,150 --> 00:05:33,199
cameras operating together it's very

136
00:05:36,390 --> 00:05:34,160
clear

137
00:05:38,070 --> 00:05:36,400
that after the servicing mission is over

138
00:05:40,469 --> 00:05:38,080

astronomers will be using this

139
00:05:42,790 --> 00:05:40,479
combination of wide field camera 3 and