



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
00:00:38,709 --> 00:00:35,590
about 7 35 eastern standard time hubble

5
00:00:41,350 --> 00:00:38,719
entered into inertial hold safe modes he

6
00:00:44,310 --> 00:00:41,360
noticed spikes on the structure current

7
00:00:46,150 --> 00:00:44,320
and the main bus current we believe that

8
00:00:48,470 --> 00:00:46,160
this is indicative of a short circuit

9
00:00:55,350 --> 00:00:48,480
that occurred in the advanced camera for

10
00:01:00,709 --> 00:00:58,549
acs was inserted on hubble in 2002

11
00:01:02,709 --> 00:01:00,719
before it died it was the most heavily

12
00:01:05,990 --> 00:01:02,719
used instrument on hubble

13
00:01:07,109 --> 00:01:06,000

acs was our best survey camera so it was

14

00:01:09,510 --> 00:01:07,119

able to

15

00:01:11,190 --> 00:01:09,520

for example map the distribution of dark

16

00:01:12,789 --> 00:01:11,200

matter and space no one had ever done

17

00:01:14,950 --> 00:01:12,799

that before

18

00:01:17,270 --> 00:01:14,960

acs was critical to our study of dark

19

00:01:19,590 --> 00:01:17,280

energy surveying the

20

00:01:21,510 --> 00:01:19,600

the galaxies out across space for

21

00:01:23,429 --> 00:01:21,520

exploding stars supernovae that would

22

00:01:25,350 --> 00:01:23,439

indicate how far away those galaxies

23

00:01:32,789 --> 00:01:25,360

were and how fast they're moving away

24

00:01:38,710 --> 00:01:36,230

so we were pretty far along on stis

25

00:01:41,270 --> 00:01:38,720

and then acs failed and that was really

26
00:01:42,310 --> 00:01:41,280
late in the game what failed is a power

27
00:01:43,990 --> 00:01:42,320
supply

28
00:01:45,910 --> 00:01:44,000
and in fact in the acs there were two

29
00:01:47,830 --> 00:01:45,920
power supplies one

30
00:01:49,590 --> 00:01:47,840
redundant set of power supplies so one

31
00:01:53,030 --> 00:01:49,600
of them failed and they switched to the

32
00:01:55,670 --> 00:01:53,040
other side and the other one then failed

33
00:01:57,350 --> 00:01:55,680
so there was not much time but it was

34
00:01:59,990 --> 00:01:57,360
decided to see if we could come up with

35
00:02:01,590 --> 00:02:00,000
a fix for it

36
00:02:02,709 --> 00:02:01,600
we leveraged what we learned on this

37
00:02:04,870 --> 00:02:02,719
disk job

38
00:02:07,190 --> 00:02:04,880

you know how to get to those components

39

00:02:09,350 --> 00:02:07,200

how to remove large numbers of fasteners

40

00:02:11,350 --> 00:02:09,360

with fastener capture plates how to

41

00:02:13,589 --> 00:02:11,360

build special tools for the astronauts

42

00:02:16,710 --> 00:02:13,599

to do the job

43

00:02:18,390 --> 00:02:16,720

just getting the thing to work in this

44

00:02:20,150 --> 00:02:18,400

amount of time

45

00:02:22,390 --> 00:02:20,160

has been difficult we're running

46

00:02:24,790 --> 00:02:22,400

probably two to three times faster than

47

00:02:27,350 --> 00:02:24,800

a typical program getting things from

48

00:02:29,510 --> 00:02:27,360

concept to design to actual

49

00:02:31,990 --> 00:02:29,520

cutting metal and building things

50

00:02:33,110 --> 00:02:32,000

it has become one of the fortes of our

51

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

program

52

00:02:41,030 --> 00:02:35,360

that our people are really really good

53

00:02:45,190 --> 00:02:43,110

removing the card the the cards that

54

00:02:46,949 --> 00:02:45,200

we're taking out are very similar to the

55

00:02:49,030 --> 00:02:46,959

card that's being removed in this disc

56

00:02:51,030 --> 00:02:49,040

repair and in this disk repair they are

57

00:02:52,550 --> 00:02:51,040

going into where the power supply is

58

00:02:53,589 --> 00:02:52,560

because that was also a power supply

59

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

failure

60

00:02:57,910 --> 00:02:56,000

so they're taking off 111 screws for

61

00:02:59,750 --> 00:02:57,920

stis and it's

62

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

32 for us

63

00:03:04,949 --> 00:03:02,959

we had learned an awful lot on stis we

64

00:03:07,110 --> 00:03:04,959

knew how to get to these places we knew

65

00:03:09,430 --> 00:03:07,120

how to pull covers off we knew how to

66

00:03:12,070 --> 00:03:09,440

pull cards out now the problem was could

67

00:03:20,149 --> 00:03:12,080

we do it where acs

68

00:03:23,110 --> 00:03:21,750

these instruments were never designed to

69

00:03:25,350 --> 00:03:23,120

be opened up

70

00:03:26,949 --> 00:03:25,360

by astronauts in space and certainly not

71

00:03:29,430 --> 00:03:26,959

by astronauts in space working in big

72

00:03:31,509 --> 00:03:29,440

bulky spacesuits

73

00:03:32,869 --> 00:03:31,519

so we needed to make sure that what we

74

00:03:35,190 --> 00:03:32,879

were doing was something that could be

75

00:03:36,869 --> 00:03:35,200

done by an astronaut in zero gravity

76

00:03:38,390 --> 00:03:36,879

with this big puffy suit around them

77

00:03:40,630 --> 00:03:38,400

constraining their movements and not

78

00:03:42,390 --> 00:03:40,640

only that but it's inside what's called

79

00:03:44,789 --> 00:03:42,400

the aft shroud of the hubble space

80

00:03:46,470 --> 00:03:44,799

telescope so there's the space is kind

81

00:03:48,949 --> 00:03:46,480

of confined they have these doors that

82

00:03:51,190 --> 00:03:48,959

they open up and can get in

83

00:03:52,789 --> 00:03:51,200

but where we're actually going in is

84

00:03:53,830 --> 00:03:52,799

kind of they kind of have to reach

85

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

around

86

00:03:56,390 --> 00:03:55,120

some of the stuff

87

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

and not work right in front of their

88

00:04:00,309 --> 00:03:57,920

faces

89

00:04:02,470 --> 00:04:00,319

the primary detector of the acs what's

90

00:04:04,390 --> 00:04:02,480

known as the wide field channel is a ccd

91

00:04:08,070 --> 00:04:04,400

just like in your digital camera

92

00:04:10,309 --> 00:04:08,080

only it's 16 megapixels so there's a box

93

00:04:11,670 --> 00:04:10,319

that controls that the ceb and that's

94

00:04:13,670 --> 00:04:11,680

what we're taking out and it's probably

95

00:04:15,350 --> 00:04:13,680

fine it actually is probably still

96

00:04:19,110 --> 00:04:15,360

working but that's the easiest way to

97

00:04:21,830 --> 00:04:19,120

get in and get new power into the system

98

00:04:23,430 --> 00:04:21,840

we had to design a a plate that goes on

99

00:04:25,430 --> 00:04:23,440

top of where we're taking off the screws

100

00:04:27,749 --> 00:04:25,440

sort of clips on there and has little

101
00:04:28,390 --> 00:04:27,759
holes in them for the screwdriver to go

102
00:04:31,030 --> 00:04:28,400
through

103
00:04:32,710 --> 00:04:31,040
the bit and those are too small for the

104
00:04:35,350 --> 00:04:32,720
screws to pass through and that was

105
00:04:37,030 --> 00:04:35,360
designed for the stis repair

106
00:04:38,550 --> 00:04:37,040
and they had a very large one with lots

107
00:04:40,550 --> 00:04:38,560
of different types of screws and we were

108
00:04:43,430 --> 00:04:40,560
fortunate that we are in the end only

109
00:04:44,950 --> 00:04:43,440
taking out one size of screw

110
00:04:48,070 --> 00:04:44,960
work we're going in through the top of

111
00:04:50,070 --> 00:04:48,080
this box and there are four circuit

112
00:04:52,310 --> 00:04:50,080
cards in there we'll pull those out and

113
00:04:54,230 --> 00:04:52,320

that leaves us a hole with connectors at

114

00:04:55,909 --> 00:04:54,240

the bottom and those connectors are what

115

00:04:57,749 --> 00:04:55,919

connect to the detector and what used to

116

00:04:59,030 --> 00:04:57,759

supply power to it

117

00:05:00,390 --> 00:04:59,040

and then we'll have a little cartridge

118

00:05:02,070 --> 00:05:00,400

with four new cards in it that will

119

00:05:04,150 --> 00:05:02,080

slide into that space

120

00:05:06,070 --> 00:05:04,160

and that will

121

00:05:07,670 --> 00:05:06,080

allow us to make connections there with

122

00:05:09,670 --> 00:05:07,680

the new cards

123

00:05:11,510 --> 00:05:09,680

but also the power now will come in from

124

00:05:13,350 --> 00:05:11,520

the outside through our external power

125

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

supply

126

00:05:21,430 --> 00:05:20,230

it's particularly important to repair

127

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

acs

128

00:05:25,830 --> 00:05:24,000

because it together with the new camera

129

00:05:28,310 --> 00:05:25,840

the white field camera 3 make a

130

00:05:30,550 --> 00:05:28,320

complimentary set they have a full set

131

00:05:33,189 --> 00:05:30,560

of capabilities that astronomers need in

132

00:05:34,150 --> 00:05:33,199

cameras operating together it's very

133

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

clear

134

00:05:38,070 --> 00:05:36,400

that after the servicing mission is over

135

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

astronomers will be using this

136

00:05:42,150 --> 00:05:40,479

combination of whitefield camera 3 and