HUBBLE
TOOL TIME
SERVICING MISSION 3B

1
00:00:00,000 --> 00:00:03,537
>> ED: We completely shut it all
the way down. >> JOHN: Yep, that

2
00:00:03,537 --> 00:00:05,806
scared a lot of people, they
were afraid when, you know, you

3
00:00:05,806 --> 00:00:08,542
turn off the Hubble it might not
come back up.

4
00:00:08,542 --> 00:00:22,022
[UPBEAT MUSIC]

5
00:00:22,022 --> 00:00:25,225
>> JOHN: Hello, I'm John
Grunsfeld, NASA astronaut.

6
00:00:25,225 --> 00:00:28,228
>> ED: I'm Ed Rezac, EVA
engineer for the Hubble Space

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00:00:28,228 --> 00:00:29,830
Telescope project.

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00:00:29,830 --> 00:00:32,399
>> JOHN: The Hubble is our
premiere observatory orbiting

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00:00:32,399 --> 00:00:36,503
the Earth 300 miles above the
surface, unraveling the

10
00:00:36,503 --> 00:00:41,642
mysteries of the universe. Now
Hubble has done that for almost

11
00:00:41,642 --> 00:00:46,980

30 years, because we did five
missions to upgrade and service

12
00:00:46,980 --> 00:00:52,052
the telescope. Now in 2002, we
did a mission that that repaired

13
00:00:52,052 --> 00:00:56,023
some instruments, but also
worked on the power system.

14
00:00:56,023 --> 00:00:58,025
>> ED: That's right. >> JOHN:
That was really important

15
00:00:58,025 --> 00:00:59,960
because there were
indications the power

16
00:00:59,960 --> 00:01:03,363
system might be failing.
>> ED: It was the first time

17
00:01:03,363 --> 00:01:07,367
since the Hubble launched in
1990 that we

18
00:01:07,367 --> 00:01:10,737
completely shut it all the way
down. >> JOHN: Yep, that scared

19
00:01:10,737 --> 00:01:13,206
a lot of people there, afraid
when, you know, you turn off the

20
00:01:13,206 --> 00:01:17,411
Hubble it might not come back
up. But fortunately, it worked

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00:01:17,411 --> 00:01:22,215

great. We spent a lot of time
figuring out how are we possibly

22
00:01:22,215 --> 00:01:25,953
gonna remove the main switch box
for Hubble? Where all the power

23
00:01:25,953 --> 00:01:30,891
goes through, 36 big connectors,
all while the Hubble is turned

24
00:01:30,891 --> 00:01:34,361
off and starting to get cold.
You know, it’s cold in space,

25
00:01:34,361 --> 00:01:38,098
Hubble could freeze. >> ED: All
the connectors, by the way, on

26
00:01:38,098 --> 00:01:42,336
the left side of the instrument.
So we had to find a left handed

27
00:01:42,336 --> 00:01:44,738
astronaut to do the work.
>> JOHN: Now where would you

28
00:01:44,738 --> 00:01:48,608
find a left-handed astronaut? So
I’m left handed, but pretty

29
00:01:48,608 --> 00:01:51,578
ambidextrous, most space-walkers
are pretty ambidextrous. Now I’m

30
00:01:51,578 --> 00:01:54,848
wearing these gloves because
these are gloves kind of like

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00:01:54,848 --> 00:01:58,352

the spacewalking gloves that we wear. So we have to build tools

32
00:01:58,352 --> 00:02:00,954
that have features that allow you to use them in the

33
00:02:00,954 --> 00:02:04,925
spacesuit. And just grabbing the connectors, we weren't sure

34
00:02:04,925 --> 00:02:07,894
that, one, I could even get my fingers between all of the

35
00:02:07,894 --> 00:02:11,598
connectors cause there were so many. And also, it was really

36
00:02:11,598 --> 00:02:14,634
hard to reach them because of all the cables coming out. So we

37
00:02:14,634 --> 00:02:17,838
had a tough time coming up with ideas, and I remember

38
00:02:17,838 --> 00:02:22,209
discussions with your boss, Frank Cepollina, the big tool

39
00:02:22,209 --> 00:02:26,613
inventor, of building motorized tools. Now we have motorized

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00:02:26,613 --> 00:02:31,518
tools right? >> ED: We do, we do. Like the PGT. >> JOHN: The

41
00:02:31,518 --> 00:02:34,955

Pistol Grip Tool. >> ED: True!
>> JOHN: Yep, that's our power

42
00:02:34,955 --> 00:02:38,158
screwdriver to loosen bolts,
tighten bolts. >> ED: But it

43
00:02:38,158 --> 00:02:42,396
wasn't going to do us much good
to reach in and turn those

44
00:02:42,396 --> 00:02:45,999
electrical connectors. >> JOHN:
Nope. So we looked at what was

45
00:02:45,999 --> 00:02:50,103
available for doing avionics,
for repairing airplanes, and

46
00:02:50,103 --> 00:02:54,041
they had connector tools that
were kind of like pliers. And we

47
00:02:54,041 --> 00:02:57,277
tried those in the training, but
they just didn't have enough

48
00:02:57,277 --> 00:03:00,380
grip and they were really hard
to use because you had to kind

49
00:03:00,380 --> 00:03:04,017
of do it two-handed to be able
to hold it. >> ED: So we had to

50
00:03:04,017 --> 00:03:08,622
come up with a tool that would
allow John to move those

51
00:03:08,622 --> 00:03:12,125

connectors or release those
connectors while wearing those

52
00:03:12,125 --> 00:03:16,296
spacesuit gloves. >> JOHN: Now
sometimes we come up with

53
00:03:16,296 --> 00:03:20,700
complex tools to solve the
problem using computer chips and

54
00:03:20,700 --> 00:03:24,638
motors and batteries. In this
case, we came up with the high

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00:03:24,638 --> 00:03:30,143
torque, PCU, Power Control Unit
Connector Tool, and it’s really

56
00:03:30,143 --> 00:03:32,913
simple. This is actually my
favorite [ED LAUGHS] Hubble

57
00:03:32,913 --> 00:03:37,017
tool, 1. Because it worked
great, and 2. Because it’s very

58
00:03:37,017 --> 00:03:41,421
simple. It allowed me, in my
gloved hand, to hold the tool,

59
00:03:41,421 --> 00:03:47,160
my left hand. Grab a connector
and rotate it to take it off and

60
00:03:47,160 --> 00:03:51,598
rotate it back when we had the
new unit to put it on. And of

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00:03:51,598 --> 00:03:55,268

course, if I let go of the tool
it would float off into space,

62
00:03:55,268 --> 00:03:59,072
so I'd have a little ring so I
could put a little hook on it

63
00:03:59,072 --> 00:04:02,242
and it was attached to me with a
spring, so if I let go of it it

64
00:04:02,242 --> 00:04:05,278
would go [SHWOOP SOUND] back.
>> ED: So even though it's a

65
00:04:05,278 --> 00:04:09,216
relatively simple tool, a lot
went into it, [TOOL SQUEEKS]

66
00:04:09,216 --> 00:04:11,718
into the design [TOOL SQUEEKS]
to make sure it was astronaut

67
00:04:11,718 --> 00:04:16,389
friendly. You've got the
extra-long handles, the tether

68
00:04:16,389 --> 00:04:20,694
loop as John pointed out to
maintain control of it, [TOOL

69
00:04:20,694 --> 00:04:23,897
SQUEEKS] and then of course the
silicone to really give a good

70
00:04:23,897 --> 00:04:28,135
grip on the back shells of the
connectors. >> JOHN: Yep, the

71
00:04:28,135 --> 00:04:31,605

silicone pads were great because
they'd give a little bit, so

72
00:04:31,605 --> 00:04:35,108
when I grabbed the connector I
could squeeze really hard to

73
00:04:35,108 --> 00:04:38,812
make sure that it didn't slip
cause that would be bad. So we

74
00:04:38,812 --> 00:04:42,249
changed out 36 of these big
connectors with heavy duty

75
00:04:42,249 --> 00:04:46,119
wires, took out the old failed
unit, put in the new one, put

76
00:04:46,119 --> 00:04:51,124
the new connectors on, turned
the power back on Hubble, and

77
00:04:51,124 --> 00:04:52,959
fortunately it all came back to
life. >> ED: Yes.

78
00:04:52,959 --> 00:04:55,362
>> JOHN: Thanks for the great
tool.

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00:04:55,362 --> 00:04:58,632
>> ED: Thanks for using it!

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00:04:58,632 --> 00:05:02,302
[UPBEAT MUSIC]

81
00:05:02,302 --> 00:05:08,580
[SILENCE]

82
00:05:08,580 --> 00:05:11,411
>> JOHN: Got that zoom
focus in there? >> OFF: Uh huh.

83
00:05:11,411 --> 00:05:13,747
>> JOHN: Want to make sure it’s
in focus. >> OFF: It is. Totally

84
00:05:13,747 --> 00:05:18,351
is. >> OFF: It’s his favorite.
>> JOHN: It is my favorite.

85
00:05:18,351 --> 00:05:27,060
[UPBEAT MUSIC]

86
00:05:27,060 --> 00:05:29,996
>> JOHN: That's right. For the
sequel. >>ED: For the sequel?