HUBBLE
TOOL TIME
SERVICING MISSION 3A

1
00:00:00,033 --> 00:00:02,402
>> JOHN: So at the end I can
lift this up and say “John out”

2
00:00:02,402 --> 00:00:06,206
and drop it? [LAUGHTER]
>> OFF: If you want to?

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00:00:06,206 --> 00:00:18,218
[UPBEAT MUSIC]

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00:00:18,218 --> 00:00:21,588
>> JOHN: Hello, I’m John
Grunsfeld, NASA astronaut.

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00:00:21,588 --> 00:00:24,625
>> ED: And I’m Ed Rezac, EVA
engineer for the Hubble Space

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00:00:24,625 --> 00:00:28,562
Telescope project at Goddard.
>> JOHN: Hubble is an amazing

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00:00:28,562 --> 00:00:32,165
observatory orbiting the Earth,
it’s allowing us to unravel the

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00:00:32,165 --> 00:00:37,771
mysteries of the Universe. But
in 1998, Hubble lost its

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00:00:37,771 --> 00:00:40,908
gyroscopes, and it stopped
doing science.

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00:00:40,908 --> 00:00:44,645
At the time I was
training for the third Hubble

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00:00:44,645 --> 00:00:48,248
servicing mission. But because
all of those gyroscopes had

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00:00:48,248 --> 00:00:52,819
failed it was a Hubble
emergency. And so NASA decided

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00:00:52,819 --> 00:00:55,222
to split our mission in two,
>> ED: That's right. >> JOHN: So

14
00:00:55,222 --> 00:00:59,693
that we had Servicing Mission 3A
and sometime later there would

15
00:00:59,693 --> 00:01:05,966
be mission 3B. And on 3A our
primary job was to replace all

16
00:01:05,966 --> 00:01:11,104
of the gyros on the Hubble Space
Telescope. Now, this is what's

17
00:01:11,104 --> 00:01:15,776
called a rate sensor unit, this
is a mockup and inside are two

18
00:01:15,776 --> 00:01:20,314
tiny gyros. Each rate sensor
unit held two gyros. So we went

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00:01:20,314 --> 00:01:25,552
up there to replace this, and
just like all the other items on

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00:01:25,552 --> 00:01:30,157
Hubble, it has bolts that are a
standard size and the doors open

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00:01:30,157 --> 00:01:33,360
and close on Hubble so that we
could open the doors and go

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00:01:33,360 --> 00:01:36,596
inside, take out the old ones,
put in the new ones and it's

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00:01:36,596 --> 00:01:41,268
really easy right? >> ED: No, it
isn't easy. There's a lot that

24
00:01:41,268 --> 00:01:44,805
has to be done and it's gotta be
done in a very tight spot. The

25
00:01:44,805 --> 00:01:49,076
astronauts have to enter a part
of the aft shroud where the

26
00:01:49,076 --> 00:01:54,014
fixed head star trackers are and
these are very very sensitive

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00:01:54,014 --> 00:01:58,318
instruments that help find a
target for the telescope to look

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00:01:58,318 --> 00:02:03,056
at. In addition, there's a lot
going on to hook up and remove

29
00:02:03,056 --> 00:02:07,761
one of these RSUs, we've got
cables to disconnect and the

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00:02:07,761 --> 00:02:12,366
three bolts that John pointed
out. So, it's a tough spot.

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00:02:12,366 --> 00:02:14,201
>> JOHN: This was one of the
hardest things I did on the

32
00:02:14,201 --> 00:02:16,703
Hubble Space Telescope, and I
can tell you it was a very dark

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00:02:16,703 --> 00:02:20,674
and scary place in there. Not
because space is dark and scary,

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00:02:20,674 --> 00:02:24,878
but because we were told if we
bonked into the star trackers or

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00:02:24,878 --> 00:02:27,748
we hit the side of the
telescope, we could break the

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00:02:27,748 --> 00:02:31,418
Hubble. And rule number one was
don’t break the Hubble.

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00:02:31,418 --> 00:02:32,986
>> ED: Don’t break the
telescope. >> JOHN: Yep.

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00:02:32,986 --> 00:02:37,024
>> ED: And the astronaut had to
enter on your back, and the,

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00:02:37,024 --> 00:02:40,861
let's see, Steve held you by the
feet didn’t he? >> JOHN: I, I

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00:02:40,861 --> 00:02:43,497
inserted Steve- >>ED: That’s
right! >> JOHN: who’s six feet

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00:02:43,497 --> 00:02:49,369
two into the telescope and >>ED:
Those long arms came in handy

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00:02:49,369 --> 00:02:52,939
>>JOHN: Yep! >> ED: cause he's
gotta reach up over his head and

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00:02:52,939 --> 00:02:57,477
between the fixed head star
trackers to access the cable

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00:02:57,477 --> 00:03:02,482
disconnects and to get a socket
on these bolt heads. >> JOHN: So

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00:03:02,482 --> 00:03:05,752
it was tough! But we were
successful on that mission. We

46
00:03:05,752 --> 00:03:09,990
also put in a new fine guidance
sensor, we changed out one of

47
00:03:09,990 --> 00:03:13,160
the transmitters, we put in a
solid-state recorder

48
00:03:13,160 --> 00:03:16,163
>> ED: Upgraded the computer.
>> JOHN: Yep! And we also put

49
00:03:16,163 --> 00:03:18,598
some new installation on the
outside of the telescope

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00:03:18,598 --> 00:03:21,635
to keep Hubble
cool. >> ED: Hubble is cool!

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00:03:21,635 --> 00:03:24,371
JOHN: Hubble is very cool! Now
one of the things I learned on

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00:03:24,371 --> 00:03:29,943
that mission from you, and from
doing the rate sensor unit swap

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00:03:29,943 --> 00:03:33,914
is that it is a really hard task
to be inserted up in there.

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00:03:33,914 --> 00:03:35,415
>> ED: The neat thing about
doing the

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00:03:35,415 --> 00:03:38,185
multiple servicing missions
is that we learn

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00:03:38,185 --> 00:03:40,854
from each one.
>> JOHN: And on the most recent

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00:03:40,854 --> 00:03:44,825
Hubble servicing mission in
2009, we also had to replace the

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00:03:44,825 --> 00:03:48,328
gyros, cause they wear out.
>> ED: John was faced with doing

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00:03:48,328 --> 00:03:53,233
the same task again, and he came
up with kind of a novel way to

60
00:03:53,233 --> 00:03:57,137
uh make the task easier.
>> JOHN: I was thinking, you

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00:03:57,137 --> 00:04:00,707
know, it’s really hard to get
into that spot to replace these,

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00:04:00,707 --> 00:04:05,145
wouldn’t it be great if you had
a super long arm that you could

63
00:04:05,145 --> 00:04:08,248
reach in and grab the gyro to
take it out? So I went to the

64
00:04:08,248 --> 00:04:12,119
hardware store and I got one of
those pick sticks that allow you

65
00:04:12,119 --> 00:04:16,556
to grab cans off a high shelf,
and I brought it into the

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00:04:16,556 --> 00:04:21,261
neutral buoyancy laboratory one
day and we put that pick stick

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00:04:21,261 --> 00:04:23,797
into the water to see if we
could reach the gyro and we

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00:04:23,797 --> 00:04:28,902
could. Now that was a 20 buck
pick stick, and because of that

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00:04:28,902 --> 00:04:32,806
it inspired a new tool. >> ED:
It did, and, that was, I call

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00:04:32,806 --> 00:04:36,543
those “pet rock moments” cause
you see something and you go

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00:04:36,543 --> 00:04:39,479
[SMACK] well why didn’t I think
of that! But it was a beautiful

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00:04:39,479 --> 00:04:45,018
idea, so we took the concept and
we built the RSU changeout tool.

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00:04:45,018 --> 00:04:49,089
We used it, it came in handy for
the last servicing mission in

74
00:04:49,089 --> 00:04:52,792
2009. >> JOHN: Want to
demonstrate? >> ED: Absolutely!

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00:04:52,792 --> 00:04:56,863
>> JOHN: So this is the handrail
I had to grab that was so hard,

76
00:04:56,863 --> 00:05:03,370
but now. [RSU TOOL CLACKS]
>> ED: Lock it on. >> JOHN: To

77
00:05:03,370 --> 00:05:06,373
reach into the telescope and
grab it. >> ED: Pretty sweet.

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00:05:06,373 --> 00:05:08,441
>> JOHN: So that’s how we
develop new tools sometimes,

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00:05:08,441 --> 00:05:13,280
simple idea and a hard task,
make it easier. >> ED: It works!

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00:05:13,280 --> 00:05:15,215
>> JOHN: Thanks
Ed. >> ED: Thanks John.

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00:05:15,215 --> 00:05:19,085
[UPBEAT MUSIC]

82
00:05:19,085 --> 00:05:24,291
[SILENCE]

83
00:05:24,291 --> 00:05:28,061
JOHN: Hello, I'm John Grunsfeld,
NASA astronaut. >> ED: I'm Frank

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00:05:28,061 --> 00:05:33,166
Cepollina and I'll never retire.
[SOFT LAUGHTER] >> OFF: Should

85
00:05:33,166 --> 00:05:38,104
we do that one over? >> JOHN:
Yep. >> ED: Start over.

86
00:05:38,104 --> 00:05:42,742
>> JOHN: Hello, I'm Edwin
Hubble, a deceased astronomer.

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00:05:42,742 --> 00:05:51,151
[UPBEAT MUSIC]

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00:05:51,151 --> 00:05:52,519
>> JOHN: Got that
out of your system? >> ED: I

89
00:05:52,519 --> 00:05:54,321
did, I'm good. [LAUGHTER]
>> JOHN: How's that >> ED: You