1
00:00:15,429 --> 00:00:18,560
Mary Estacion/Reporter: One of the reasons
the James Webb Space Telescope will usher

2
00:00:18,560 --> 00:00:24,590
in a new era of astronomy is its unique set
of mirrors. To perform at their very best,

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00:00:24,590 --> 00:00:29,449
these mirrors need to be shaped with exact
precision. To find out just how that gets

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00:00:29,449 --> 00:00:34,539
done, we're here at L3 IOS Tinsley in Richmond,
CA.

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00:00:34,539 --> 00:00:36,610
So Ed, what's going on here?
Ed Boese/JWST Manufacturing Supervisor: Well,

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00:00:36,610 --> 00:00:41,140
we're shaping the mirror using several different
processes to take it down to about 20 nanometers

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00:00:41,140 --> 00:00:45,270
of surface error, which is about 1/5 the diameter
of a human hair.

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00:00:45,270 --> 00:00:47,120
Mary: What else are you trying to get rid
of?

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00:00:47,120 --> 00:00:51,660
Ed: We have to remove fine stratches down
to about 8/1000ths of an inch. Anything wider

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00:00:51,660 --> 00:00:56,500
than that and it starts to reflect light and
diffuse it so you don't get a good image off

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00:00:56,500 --> 00:00:59,360
the telescope.
Ed: We're removing the grinding compound,

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00:00:59,360 --> 00:01:03,470
actually it's a rough polish compound and
beryllium that's actually on the surface of

13
00:01:03,470 --> 00:01:07,150
the mirror. And we have to clean it before
we go on to the next pro- cess.

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00:01:07,150 --> 00:01:12,210
He's removing it off the part using a solvent.■Mary:
The solvent he's using... is it just Windex

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00:01:12,210 --> 00:01:15,070
or is it much more particular than that?
Ed: No, no, we can't use Windex. It has chemicals

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00:01:15,070 --> 00:01:19,250
in it that will actually attack the surface
of the beryllium and cause it to corrode,

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00:01:19,250 --> 00:01:24,490
so we have to use a isopropyl alcohol and
acetone it.

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00:01:24,490 --> 00:01:29,630
Mary: Ed showed us the cleaning of the mirrors,
so what's going on here?

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00:01:29,630 --> 00:01:33,080
Robert: After rough polishing, we have to
get rid of the texture that's left on the

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00:01:33,080 --> 00:01:38,439
surface. The smoothing process will plane
over that texture and give us a true mirror

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00:01:38,439 --> 00:01:40,150
surface.
Mary: Could you do this by hand?

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00:01:40,150 --> 00:01:45,040
Robert: People used to do this by hand, but
you could not make these mirrors by hand.

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00:01:45,040 --> 00:01:49,220
It would be very difficult not to have residual
texture in these mirrors.

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00:01:49,220 --> 00:01:54,210
Mary: It looks like water, is it water?
Robert: No, it's not water. It has a fine

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00:01:54,210 --> 00:01:59,831
abrasive particle in it and some other chemistries
that we know work well with beryllium. Beryllium

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00:01:59,831 --> 00:02:06,290
is a very difficult metal to polish
Mary: So Robert, it kind of reminds of what

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00:02:06,290 --> 00:02:11,390
women try to do, exfoliate their skin, trying
to get rid of that top layer of skin cells,

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00:02:11,390 --> 00:02:15,940
to show a brighter layer underneath?
Robert: Well, the mirror surface, when it

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00:02:15,940 --> 00:02:21,810
comes to this process has a texturing on it,
so this process will take the little peaks,

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00:02:21,810 --> 00:02:27,389
saw it off, saw it off, until finally, you
have this perfect plane. And these are not

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00:02:27,389 --> 00:02:30,870
flat mirrors, but you want that surface to
be just very continuous.

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00:02:30,870 --> 00:02:36,419
Robert: If it has roughness in it, it won't
perform well, because each little lump and

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00:02:36,419 --> 00:02:41,020
bump on the surface reflects light in a different
direction and so it doesn't come back to the

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00:02:41,020 --> 00:02:46,590
detectors. So this process helps it to be
extremely uniform so you have the maximum

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00:02:46,590 --> 00:02:49,629
amount of surface area returning the light
for you.

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00:02:49,629 --> 00:02:52,159
Mary: Well, thanks a lot for showing us this.
Robert: Thank you.

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00:02:52,159 --> 00:02:58,379
Mary: So, these processes the mirrors go through,
like the rough polishing are done over and

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00:02:58,379 --> 00:03:04,129
over again to make sure the mirrors on the
James Webb Space Telescope have a smooth surface